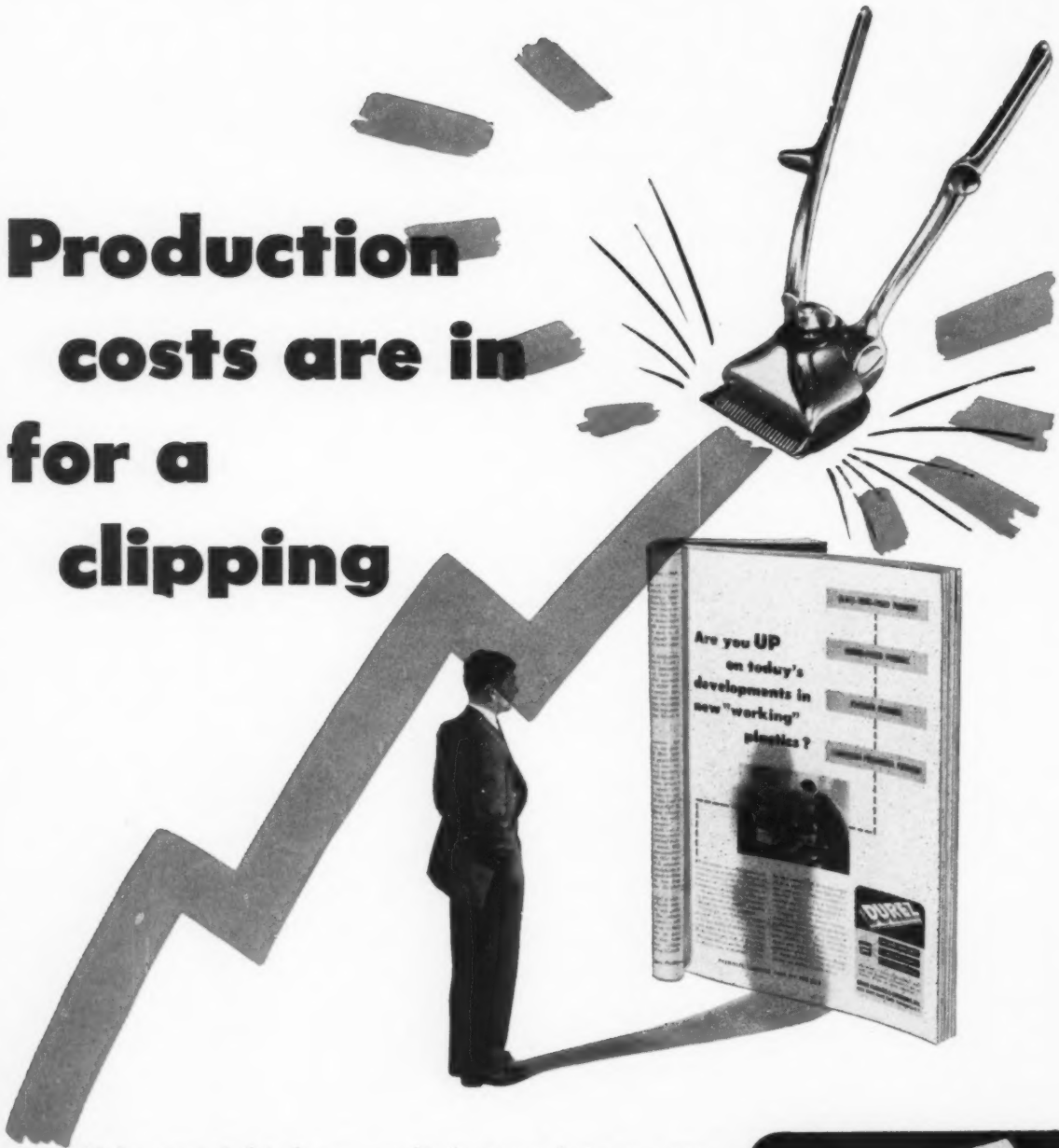
MODERN PLASTICS

NOVEMBER 1953

Production costs are in for a clipping



No longer a goal of the future but available now is a phenolic material, glass fiber* filled yet readily moldable, with unheard of impact strengths ranging up to 20 foot-pounds per inch (Izod).

This is one of several new plastic compounds of the "working" class . . . the multi-purpose phenolic materials . . . developed by Durez to extend into new fields the economies of the molding process. In your business they may be the turning point in eliminating numerous machining, assembly, finishing, and other operations.

Further possibilities for cutting costs are in a lustrous yet resilient new rubber-filled Durez phenolic, and still another that ends the danger of corrosion of silver contacts.

These new kinds of materials invite your investigation with more than dollar economies in mind. Look into them for products that look better, serve longer, and sell easier!

Durez phenolics specialists will gladly confer with you and your custom molder.

*Owens-Corning Fiberglas

PHENOLIC PLASTICS THAT FIT THE JOB

Our monthly "Durez Plastics News" will keep you informed on industry's uses of Durez. Write on office letterhead.

DUREZ PLASTICS & CHEMICALS, INC.
1211 Walck Road, North Tonawanda, N. Y.

Make merry, the way... *Catalin Styrene* is riding with Santa Claus!

The Gem of Plastics adds to the joy derived from Paramount's* new, all-action table decoration

"By the glow of a guiding beacon, Santa, his toy-packed sleigh and brace of ribbon-reined reindeer, go a-bobbing o'er mounds of wind-blown snow . . . and, to the tuneful tinkle of 'Jingle bells, jingle bells, jingle all the way'!" What an irresistible attraction!

All but the reins, music box and bulb are molded of CATALIN STYRENE, in colors appropriate to Christmas . . . Yes, even the working parts which propel the fascinating action (*you can't see them—they're buried under the "snow"*) are CATALIN STYRENE-molded!

"This year", Santa Claus tells us, "my molders are designing more of their toys and gifts of CATALIN STYRENE. It's so strong, so adaptable and so superior . . . I can now well understand why this material is so highly regarded as 'the gem of plastics'."

**Product of Raylite Electric Corp., Bronx 51, N. Y.*
Custom-molded by Jamison Plastics Corp., Freeport, L. I.

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

CATALIN

In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations.

MODERN PLASTICS*

November 1953 • Vol. 31, No. 3

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Modern Plastics, published monthly by Breskin Publications, Inc., at Emmett St., Bristol, Conn. Executive and Editorial Office: 575 Madison Ave., New York 22, N. Y. Entered as second class matter at the Post Office at Bristol, Conn., December 14, 1950, under the Act of March 3, 1879. Modern Plastics is regularly indexed in Industrial Arts Index and Industex. Subscription $6.00 a year, $11.00 for two years, $15.00 for three years in the U.S., its possessions, South America, and Canada. All other countries $12.00 a year, $20.00 for two years, $28.00 for three years, payable in U.S. currency. Price of this issue 75 cents per copy in the U.S., its possessions, South America, and Canada; all other countries $1.25. Printed in the U.S.A. by the Hildreth Press, Inc., Bristol, Conn.

*Reg. U.S. Pat. Office

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EDITORIAL

Standards — and Marketing

With the establishment of the Vinyl Standards Educational Committee under the auspices of S. P. I., and with the proposal of this committee to engage in a major advertising and publicity campaign to trades and consumers, the Plastics Industry may have reached an important turning point in its progress toward public appreciation and acceptance.

Standards, the development of standards, the application of standards, and the policing of standards are expensive. And they are only as valuable as the consumer believes them to be. Therefore standards, once established, must be sold.

But when the value of standards on any type of plastics material or product has been sold, the market value of the standard to the makers of the plastics material or product increases—and since the standards are invariably minimum, the opportunity for larger volume of satisfactory sales is greater.

We presently have standards for melamine tableware, for polystyrene wall tile, for vinyl film, for both decorative and electrical-grade high pressure laminates. Standards are being developed for plastics monofilaments, thermoplastic pipe, thermoplastic structures, and a variety of reinforced plastics materials including electrical-grade sheets, flat structural sheets, and corrugated sheeting for the building people. And it now appears that it may be possible to standardize polyethylene film.

We believe that there is a market value to good intention. And we believe that not only should present standards for plastics materials and products be given much more publicity than they have to date, but publicity should be given also to the fact that these other standards are under development.

It has been argued that mention of intention to secure standards might create consumer suspicion of a presently unstandardized range of merchandise. In our opinion, today's public and today's industrial consumer are sufficiently sophisticated to render this argument untenable. Indeed, progress report publicity on the various standards development programs can have a salutary effect on current sales—particularly for individual manufacturers who upgrade immediately to the point of or above the probable minimum standards, and who say so in public.

Whether or not a group of manufacturers sees fit to publicize its progress towards standards, once a standard has been established it is the duty, not only of the group, but of each manufacturer in the group to capitalize on the market value of the standards by putting the full weight of publicity behind them.

NEW CUMBERLAND "STAIR-STEP" DICING METHOD

Dices FULL RANGE of Plastic Materials!

"STAIR-STEP" DICING MACHINE

Plastic sheet material enters machine at right and is processed into cubes below.

CUTS SHEET STOCK INTO UNIFORM CUBES!

Now You Can Choose From TWO Cumberland Dicing Methods

NEW "STAIR-STEP" METHOD is the "universal" dicing method. It dices the *full range* of plastic materials having widely varying physical properties.

WELL-KNOWN "NOTCHED-KNIFE" METHOD dices vinyl materials of medium plasticizer content, vinylidene chloride, and other materials having suitable physical properties.

NOTCHED-KNIFE DICING MACHINE

Cumberland's "Stair-Step" dicing method offers you a *completely new* method of dicing. Perfect cubes are cut from sheet stock in one shearing action! All sides of cubes are cut cleanly. Cubes or rectangular pellets may be produced in various sizes (3/16" to 1/2") by simply changing knives.

WRITE FOR COMPLETE INFORMATION!

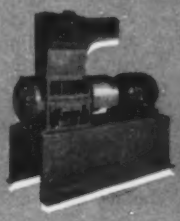
This new dicing principle makes it possible to dice the *full range* of plastic materials, including polyethylene, vinyl, acetate, and nylon. Two standard machine sizes accommodate sheets up to 7" or 14" wide. Machines to handle greater widths specially built.

CUMBERLAND MANUFACTURES A COMPLETE LINE OF PLASTICS REDUCING MACHINES

Designed Specifically for Plastics . . . . To Give You Maximum Operating Efficiency and Economy

GRANULATING MACHINES (All Models)

Eight different models, direct coupled and V-belt driven, are available to meet your requirements. For complete details, request Bulletin 251.



20" ALL-STEEL GRANULATOR

Rugged machine for granulating large "difficult-to-process" plastic parts. Eliminates prior band-sawing. 8" x 20" throat opening.

PREBREAKER

Cuts up refrigerator panels, radio, television cabinets, polyethylene bottles and containers. Available with 20" x 32" or 10" x 24" throat opening.

CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINERY FOR THE PLASTICS INDUSTRY

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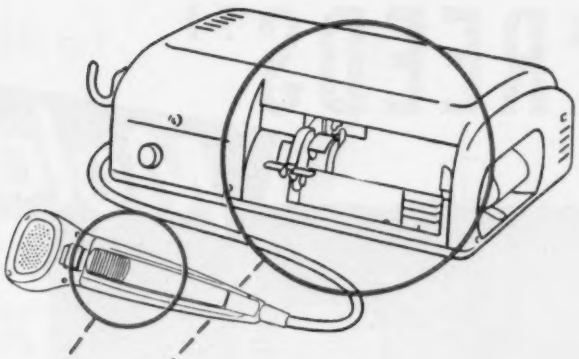
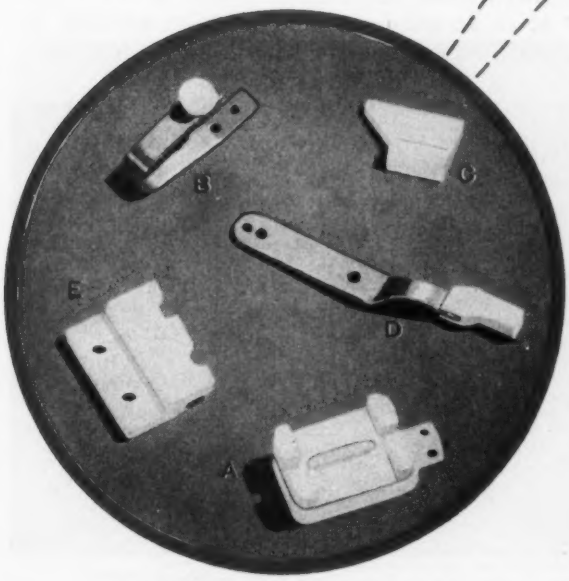


Parts of Du Pont nylon resist wear and abrasion



Parts molded of Du Pont nylon for the Dictaphone Corp., New York, N. Y., by Watertown Mfg. Co., Watertown, Conn., and Bridgeport Plastics & Rubber Co., Bridgeport, Conn.

... need no lubrication ... have excellent dielectric properties ... improve performance

Here's how key parts of Du Pont nylon have improved the performance of the Dictaphone Corporation's new Time-Master dictating machine. The *recorder coil bobbin* (a) is molded of Du Pont nylon because nylon is strong and tough in thin sections and has excellent insulating properties. Terminals can be riveted directly to it—eliminating an insulating part and cutting assembly time. The *microphone hook actuating lever* (b) required a material with good thermal stability. Molded nylon withstands high operating temperatures (up to 250°F.). These UL approved parts are tough, too—stand up to hard usage without cracking or breaking.

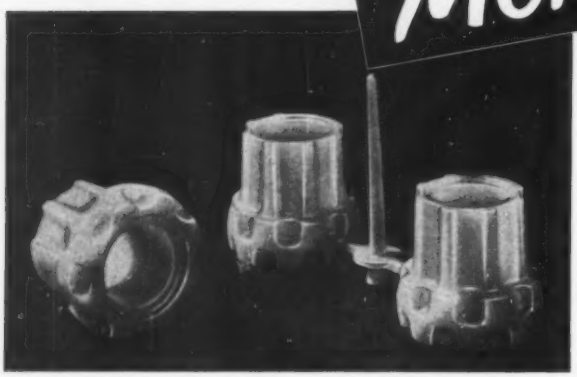
The *switch actuator* (c) and *playback actuator* (d) in the microphone utilize Du Pont nylon's easy moldability. In the switch actuator, the nylon part is used as a die insert, and the microphone handle is then molded around it. This process eliminates an assembly step and makes a virtually unbreakable joint. For the playback actuator, nylon is molded around a metal insert. These parts operate smoothly and silently without lubrication . . . resist wear over long periods.

In the *microphone sliding lock lever* (e) Du Pont nylon assures a part that slides easily and provides a slip-free, long-wearing lock. All five parts are economically produced to close tolerances by injection molding. They help lower production time and costs . . . save on assembly and maintenance.

Perhaps the unique combination of properties of molded Du Pont nylon can help you improve the design and operation of your product. For further information, write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept., Room 3011, Du Pont Bldg., Wilmington 98, Delaware.

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY
Polychemicals
DEPARTMENT
PLASTICS • CHEMICALS

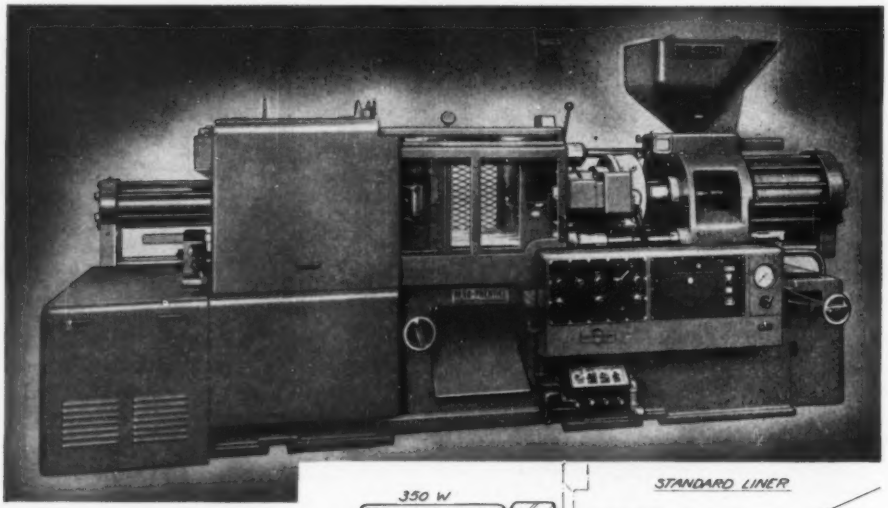
"REEDS" Mold NYLON Easily . . . Accurately



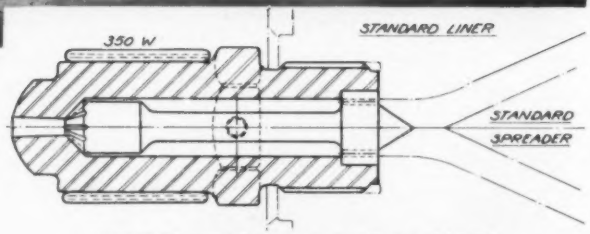
Heavy section two-cavity Nylon bearing "shot" that weighs 7½ oz. is accurately molded on a 10D-8 oz. "REED" by St. Claire Plastics, Marine City, Michigan for Timken Detroit Axle Co. of Detroit.

Standard Reed-Prentice Plastic Injection Molding Machines equipped with special "Nylon" nozzle produce intricate, durable Nylon parts for many leading molders.

Independent temperature control of the nozzle is so accurately maintained that drooling of plasticized Nylon is no problem on "REEDS".



Reed-Prentice 10D-8 oz. Injection Molding Machine—widely used in molding precision Nylon parts. Limited quantity of these 10D-8 oz. machines are available for prompt delivery.



Unique design of Reed-Prentice "Nylon" nozzle effectively prevents drooling of plasticized Nylon without any special shut-off attachment.

"REEDS" available in 4, 8, 12, 16, 20, 24, 32, 48 and 200 oz. capacities

"REEDS"—the World's Foremost Machines for EXTRA CAPACITY MOLDING

REED-PRENTICE CORP.
INJECTION MACHINES
WORCESTER MASS., U.S.A.

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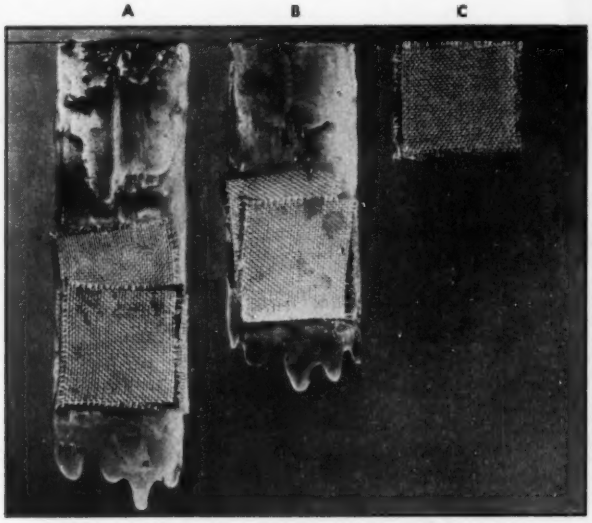
the polyester resin that

will not drain!

Celanese* MARCOTHIX†

special thixotropic liquid resin for hand lay up of gel coats on vertical surfaces and compound curves



Comparison test with resins of both high and low viscosity demonstrates how gel coatings of Marcothix remain in place on smooth finish metal panel. "A" is a resin of low viscosity (note drainage all the way down); "B," a resin of high viscosity (note drainage part way); "C" Marcothix, remains in place.

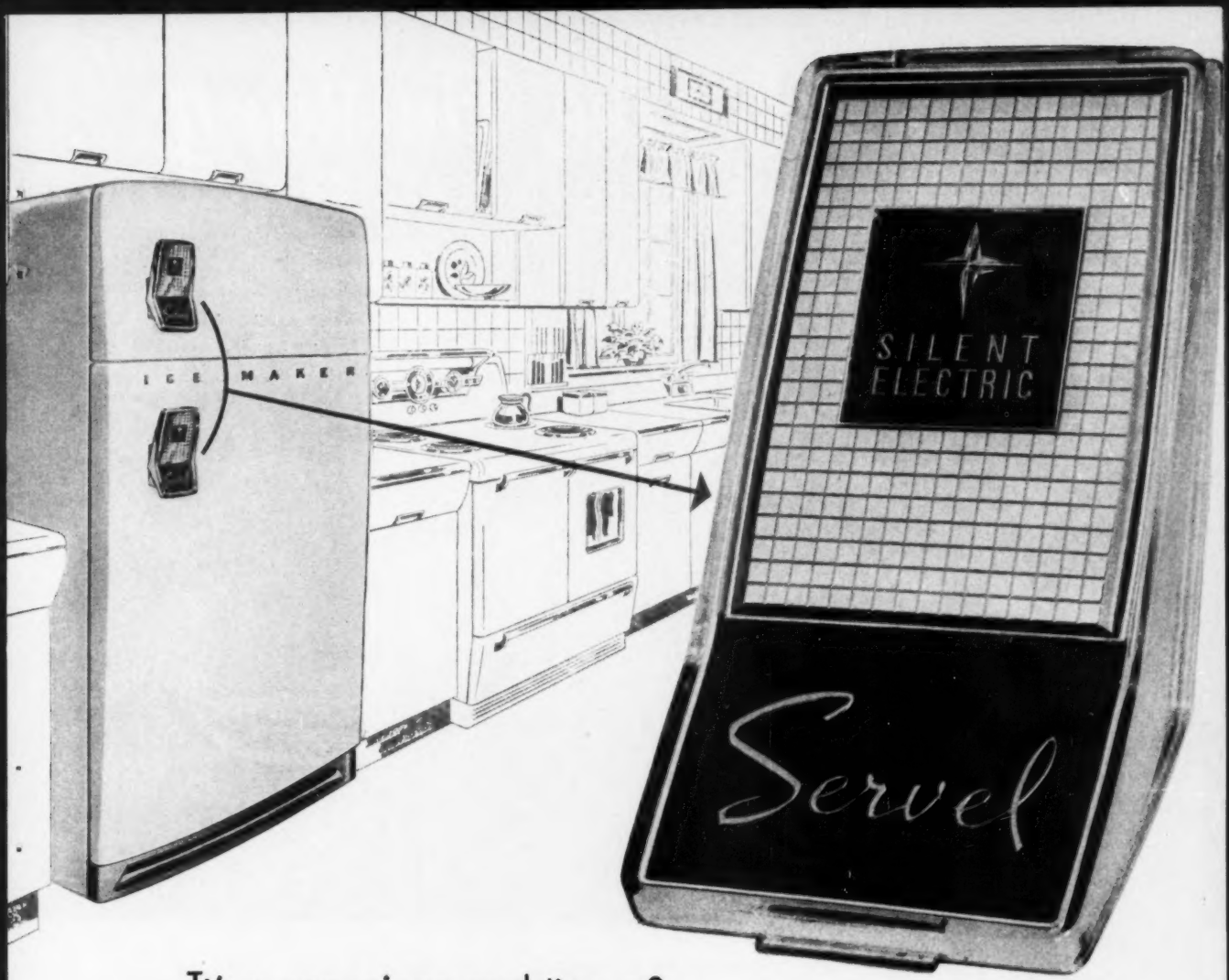
Marcothix represents an important, new advance in the polyester field—a unique method of solving the problem of resin drainage and other drawbacks to hand lay up fabrication.

A thixotropic liquid, Celanese Marcothix can be applied by spray, brush, or squeegee. When distributed evenly over vertical surfaces and complex curves, it stays put! Marcothix cuts hand lay up time by hours. Once applied it does not need constant brushing back while gelation takes place. It insures greater uniformity of thickness, porosity is reduced and finishing operations are held to a minimum.

Write for special bulletin (M-5) covering Marcothix resins as used in hand lay up production.
Celanese Corporation of America, Plastics Division, Dept. 101K, 290 Ferry Street, Newark 5, N. J.
Canadian affiliate, Canadian Chemical Company, Ltd., Montreal and Toronto.

Celanese* PLASTICS

*Reg. U. S. Pat. Off.
†Trade Mark



...It's a one-piece molding of **PLEXIGLAS**

New Servel "Automatic Ice-Maker" gas and electric refrigerators feature handles that can be operated by wrist or elbow. Colorful handle-facings, 7½" x 4" x 1½", are molded of PLEXIGLAS V-100.

The handsome face of this refrigerator handle is not an assembly of separate parts. The raised edges, the sides, lettering, markings, and background areas are all part of the same single molding—of PLEXIGLAS acrylic plastic.

The molding is transparent—metallized and spray painted on the rear surface to produce the brilliant chrome bezel effect, the mirrored and richly colored backgrounds, the gleaming letters and decorations.

In addition to eye-catching appearance, the part has excellent serviceability. Because it is molded of PLEXIGLAS, its crystal clarity does not change with age . . . and it has the strength and stability to withstand hard knocks, sudden shocks, moisture, and constant handling.

The chances are that parts molded of PLEXIGLAS can add durable sales appeal to the product *you* are designing or manufacturing, too. We will be glad to tell you how this acrylic plastic, so widely used in many fields, can meet your specific requirements.

This booklet, "PLEXIGLAS Molding Powders", describes the properties and advantages of PLEXIGLAS and shows how it is being used for molded parts and extruded sections in outdoor and indoor applications. Write to the Plastics Department for it today. You will receive it promptly.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

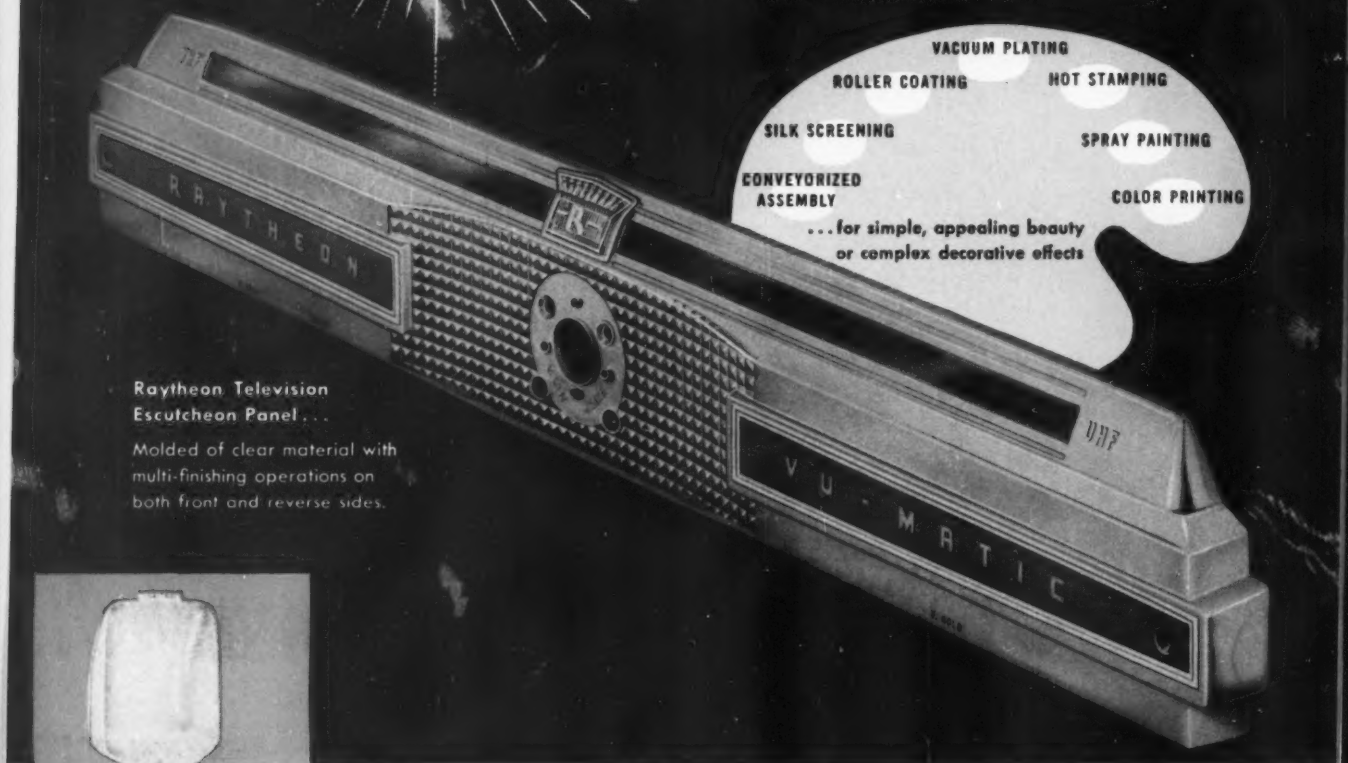
WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

PLEXIGLAS molding powders are listed in Sweet's product Design File, Section 1c/Ro.
PLEXIGLAS is a trade-mark, Reg. U. S. Pat. Off. and in principal countries of the western hemisphere
Canadian Distributor: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada*

Amos Jewel Like Finishing...

...IN PLASTICS

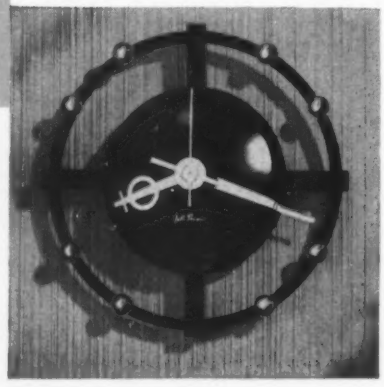


Raytheon Television Escutcheon Panel...

Molded of clear material with multi-finishing operations on both front and reverse sides.

Above—Start-rite dual baby trainer produced for Pemco Products Inc., Indianapolis, Indiana. Requires 4 molds of from 4 to 28 ounce capacity, plus five assembly and finishing operations.

Below—Clock face produced for Seth Thomas, Thomaston, Connecticut. Clock face molded in black material and treated with special satin finish



Sparkling, deep-lustre colors! Gleaming metallics!

Amos precision injection molding teams up with ingenious design and jewel-like finishing to give *your* product simple, appealing beauty or complex decorative effects.

Amos facilities are complete . . . product design and engineering . . . mold building . . . molding—4 to 300 ounce machine capacity . . . conveyorized assembly and finishing . . . vacuum plating . . . silk screening . . . hot stamping . . . roller coating . . . printing . . . spray painting—everything *your* product needs in plastics—under *one* roof—no divided responsibility.

We invite you to join the ever-growing list of Amos customers—*now*.

NO OBLIGATION . . . WRITE, WIRE OR PHONE . . .

AMOS MOLDED PLASTICS

Edinburg, Indiana

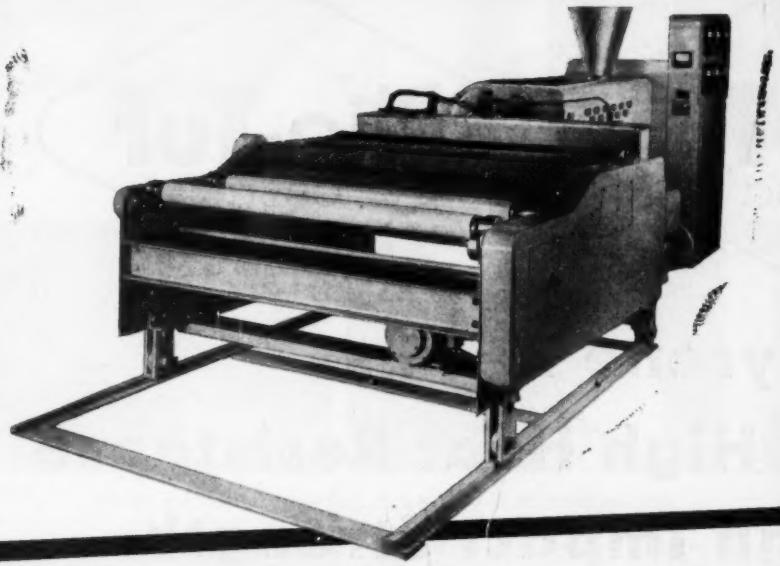
Offices: Chicago, Detroit, Philadelphia, Kansas City, Mo., Nashua, N. H.

Amos

MOLDED PLASTICS...

Custom Injection Molding Specialists

FLAT SHEET EXTRUSION



of
acetate
ethyl
cellulose
polyethylene
polyvinyl
chloride

This "complete package" contains everything needed.
Attach electricity and water...and start producing!

■ Since polyethylene, polyvinyl chloride, ethyl cellulose, and cellulose acetate films and sheeting are becoming increasingly important in packaging, vacuum forming, laminating and so forth, producers who kep a careful eye on costs are installing MPM extrusion units to supply their needs.

An MPM "complete package" film and sheeting extrusion unit is amazingly flexible. It extrudes up to 48" wide (trimmed size), in thicknesses from .001" to .010". You can shift from one plastic material to another in a very short time.

This compact, economical-to-operate set-up contains *every* necessary mechanical component. Just connect water and electric lines, pour the plastic resin into the hopper, and you soon are producing yard upon of yard of film or sheeting.

By attending a pre-shipment test run or a demonstration arranged at your convenience, you can learn how versatile this equipment is, and how easy it is to opearte. Write today for details, and for film and sheeting samples.

Ask about MPM's "complete package" units for extruding polyethylene and polyvinyl chloride roll-flat tubing for packaging purposes.

modern plastic machinery corp. mpm

15 Union St., Lodi, N. J., U. S. A.
Cable Address: MODPLASEX

West Coast Representative:
4113 W. Jefferson St., Los Angeles 16, Calif.

NEW-DIFFERENT-AND NEEDED!

Plio-Tuf G75C

Plio-Tuf G85C

High Styrene Resins Having High Heat Resistance and High Impact Strength

Heat distortion point of 195°F. @ 66 psi (ASTM D648). Notched Izod Impact of 8 ft.-lbs./in. of notch @ 77°F. High tensile strength. Hardness. Toughness. Stiffness. Light weight. Light color. Low water absorption. Excellent chemical resistance. Excellent electrical properties. Easy processability. Ready post-formability. All these are yours—without curing—without blending with rubber—in the new PLIO-TUF G75C and PLIO-TUF G85C.

NOT A RUBBER-RESIN BLEND

PLIO-TUF G75C and G85C are two completely different high styrene copolymers recently developed by Goodyear. They are pure resins—not rubber-resin blends. PLIO-TUF G75C is designed for use alone. PLIO-TUF G85C is designed for use with G75C or various rubbers to increase hardness, tensile or heat softening points. Both are now available in quantity as white powders.

NO CURING NEEDED

PLIO-TUF G75C is easily compounded and processed. Release agents and pigments are all that are needed. Extenders may be added for lower cost. Conventional rubber or plastic mixing equipment can be used. The compounds are readily calendered, extruded or molded. Polished or embossed sheets are easily post-formed by vacuum or mechanical drawing. PLIO-TUF G85C blended with PLIO-TUF G75C exhibits similar processing characteristics.

EASILY FABRICATED

Products made from PLIO-TUF resins can be sawed, drilled, punched, tapped, turned, sewed, cemented, sanded, polished, hot stamped or painted. Typical suggested uses include luggage, carrying cases, containers, tote boxes, pipe, fittings, rods, tubes, automotive and equipment parts, housings, door panels, toys, protective helmets, kitchen utensils, handles and many other molded, post-formed or fabricated items for home and industry.

Investigate the possibilities of these challenging, new PLIO-TUF resins, today. Get full information, samples and technical assistance simply by filling out the coupon.

CHEMICAL GOODYEAR DIVISION

The Goodyear Tire & Rubber Company, Inc.
Chemical Division, Akron 16, Ohio

Please send me full details and sample of new PLIO-TUF resins.

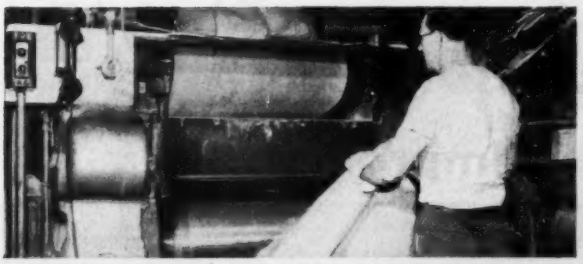
☐ I am a fabricator interested in PLIO-TUF sheets.
☐ I am a processor interested in PLIO-TUF resins.

Name_____

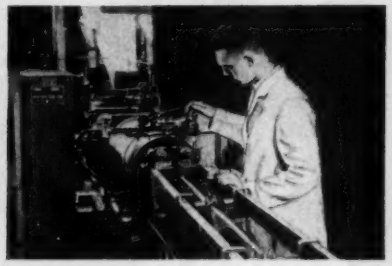
Company_____ Position_____

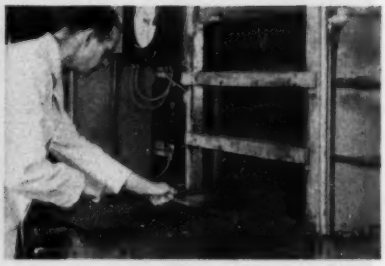
Address_____

Look What You Can Do With Plio-**Tuf!**

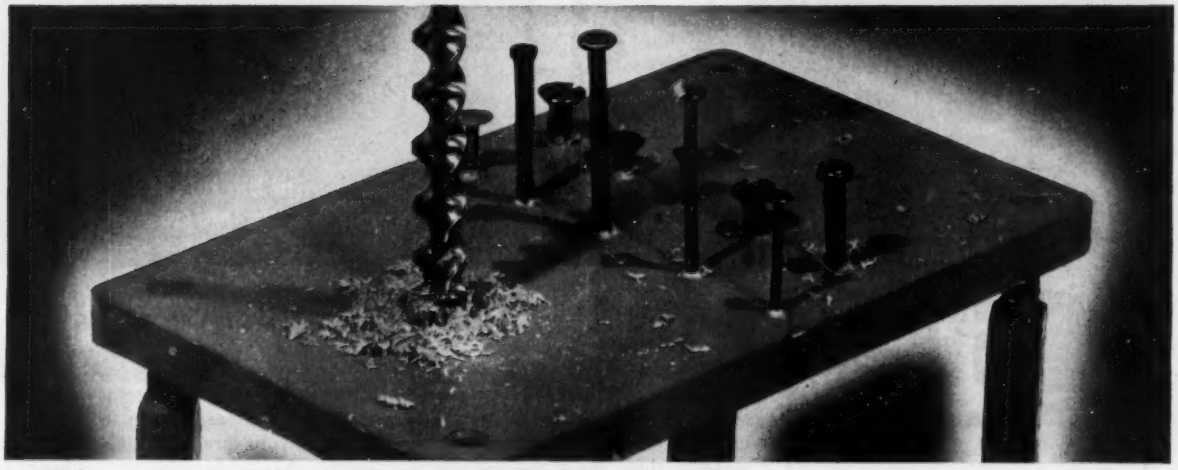


Plio-Tuf can be compounded on conventional rubber or plastic mixing equipment.

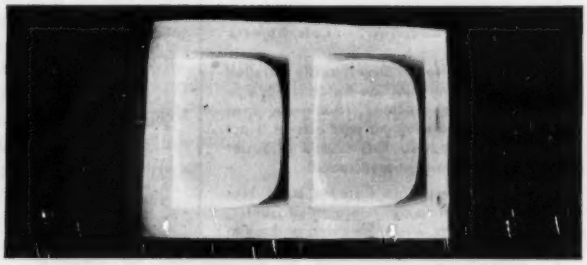




Plio-Tuf can be calendered, extruded, compression or transfer molded.



Plio-Tuf can be sawed, punched, drilled, tapped, turned, sewed, cemented, sanded, polished, hot stamped, painted.



Plio-Tuf sheets are tough, flexible—readily post-formed into items such as television masks.

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network
THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic, Wing-Stay—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

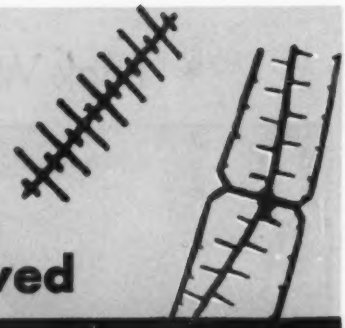
Use-Proved Products — CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS — The Finest Chemicals for Industry

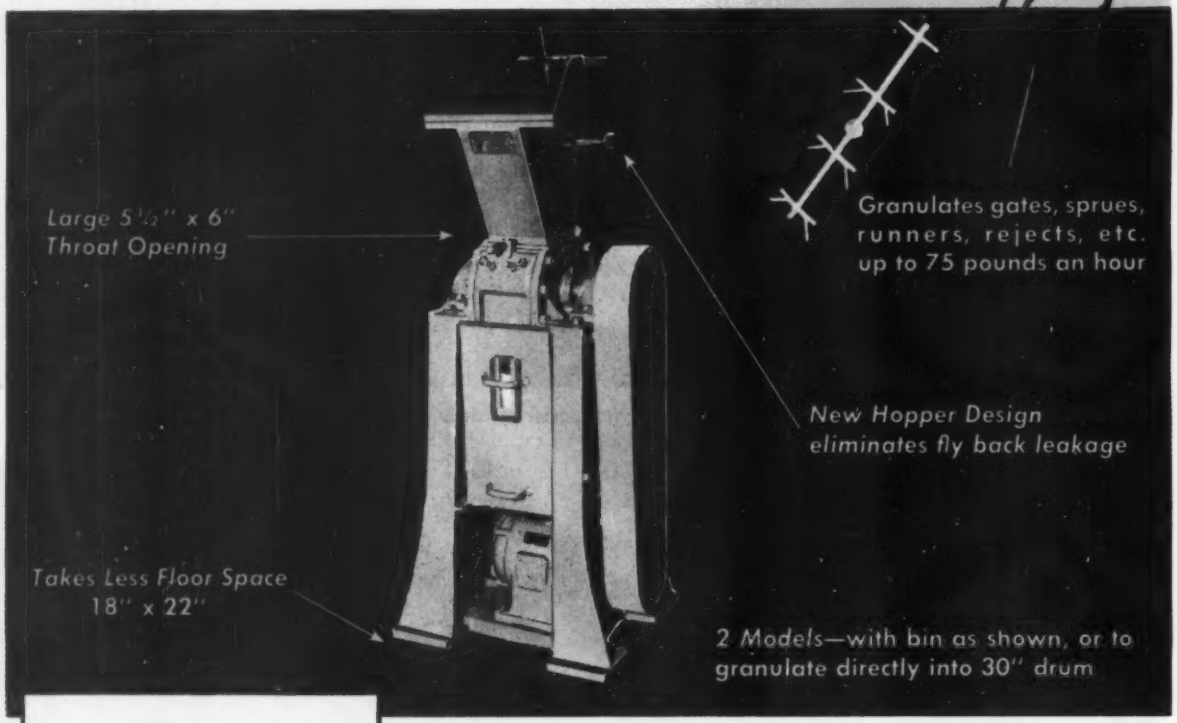
Great News!

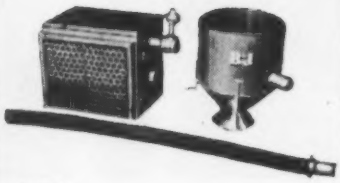
NEW MIDGET GRANULATOR

FOR BESIDE-THE-PRESS GRINDING

Now Redesigned and Improved







NEW

B & J HEATER-DRYER

(Hopper Attachment)

Speeds Production . . . Cuts Rejects

The B&J Heater-Dryer, easily installed on top of any injection molding machine or extruding machine, conditions, dries and pre-heats the material *after* it is put into the hopper. This results in easier handling and greater speed.

This new design includes many features which mean more "full shots", fewer rejects, easier cleaning and maintenance. And, because the B&J Heater-Dryer can be mounted on top of any machine, or any off-the-floor location, you save floor space.

Three models meet most needs.

Has Molder-Recommended Features...

Comparison proves the new B&J Midget Granulator offers more advantages, feature for feature. This new design was dictated by many molders throughout the country to answer every requirement.

The new B&J Midget takes the absolute minimum of floor space—18" x 22" — an important essential with space at a premium.

The large size throat will easily handle gates, sprues, runners, etc., from ⅛" to ½" sectional thickness.

All parts of the Midget are easily accessible—hopper, screen, and chute or bin are quickly removed for cleaning. Standard screen furnished to meet your granule size requirements. Available with or without casters for portability. And, the B&J Midget is sturdily built for long, trouble-free operation.

There's a B&J grinder for every need. Tell us your requirements or send samples of your material for grinding in our testing laboratory. Also write for brochure describing the complete B&J line.

REMEMBER! B&J GRINDERS ARE BUILT TO LAST LONGER!

BALL & JEWELL, INC.

22 FRANKLIN STREET EVergreen 9-6580 BROOKLYN 22, NEW YORK

What's YOUR Line?

ELECTRIC ELECTRONIC ?

RADIO TELEVISION MUSIC ?

APPLIANCES HOUSEWARES ?

SOMETHING ELSE ?

These applications demonstrate *our* line—custom moulding of thermosetting plastics. Complete moulding facilities, including design and mould-making!

Note, please, that some of these parts are quite intricate. Note, too, that while the majority of these pieces are moulded of standard thermosetting materials, quite a few are made of newer materials with which we've acquired a working knowledge almost unique in the industry. Pieces numbered 19, 20, 23, and 24 are moulded of Teflon—those numbered 2, 21 and 22, of glass-reinforced plastics—numbers 6 and 12, of Alkyd.

Based on experience like this, don't you think *your* line could benefit from service by *our* line? Phone or write our Dayton office—or your local branch office—for full information.

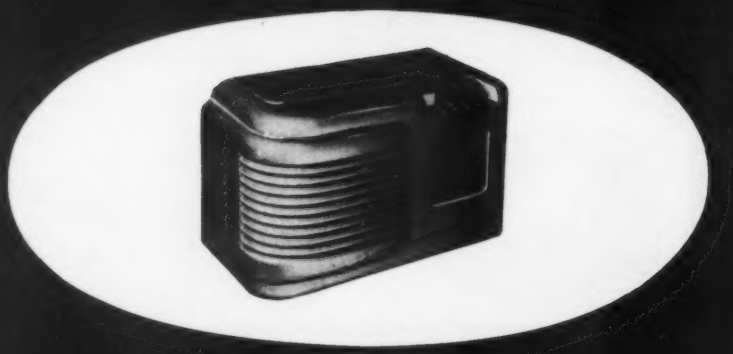
Kurz-Kasch, Inc. •1415 S. Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, Lexington 2-6677 • Rochester, Hillside 4352 • Chicago, Merrimac 7-1830 • Detroit, Trinity 3-7050 • Philadelphia, Hilltop 6-6472 • Dallas, Logan 1970 • Los Angeles, Richmond 7-5384 • St. Louis, Delmar 9577 • Toronto, Elgin 4167 EXPORT OFFICE: 89 Broad St., New York City, Bowling Green 9-7751.

Kurz-Kasch

FOR OVER 36 YEARS PLANNERS AND MOULDERS IN PLASTICS

for **TOUGH** molding jobs . . .



METASAP* STEARATES deliver easier mold release

When you have a tricky molding problem . . . when you're deep drawing or producing large pieces, Metasap Stearates in the molding compound provide outstanding lubrication for easy ejection from the mold.

Either incorporated into the molding compound or dusted onto mold surfaces Metasap Zinc or Calcium Stearates give outstanding lubrication so that lower ejection pressures are needed. Thus, you can expect increased output, fewer rejects, improved finished products and longer mold life.

So specify compounds containing Metasap Stearates or incorporate them directly into your own molding compound. Metasap Technical Service will help you with the proper material and mixing procedure for your needs.

. . . and to produce economical plastigels

As a thickening agent for plastisols, Metasap provides a complete line of quality Stearates. We'll be glad to make available to you free experimental samples of Magnesium, Barium, Calcium and Aluminum Stearates. They are ready for immediate shipment now.

METASAP CHEMICAL COMPANY, Harrison, N. J.

Branches: CHICAGO • BOSTON • CEDARTOWN, GA. • RICHMOND, CALIF.

Stocks at: Cleveland, Ohio; Louisville, Ky.; Los Angeles, Cal.; Portland, Ore.; Spokane and Seattle, Wash.

*Reg. U. S. Pat. Off.

METASAP CHEMICAL COMPANY REG. U.S. PAT. OFF.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

American Optical Company

and Nixon team up to create...

MANIKIN

Striking . . .
in the case or on the face

Here's a current example of Nixon's ability to create new decorative effects in plastics:

Recently, seeking frames with new cosmetic appeal—one's which would look striking when displayed in an optical dispenser's showcase, but which would not be garish when worn—American Optical Company designed the two-tone "Manikin" line.

But the hitch that prevented their manufacture was that no such decorative plastic material existed . . . that is, not until Nixon created it in a special cellulose nitrate.

This story is typical. When mother-of-pearl, marble, onyx, tortoise shell, fine grained woods, and other unusual, superbly beautiful effects are required in plastics, Nixon is usually called upon to develop them. These *controlled designs* and *multiple colors* can also be made in cellulose acetate, cellulose acetate butyrate, and ethyl cellulose; in sheets, rods, and tubes.

What you create on paper, we can equal in plastics. If you want to endow your products with imaginative beauty, we suggest a meeting at which you will see samples that will stimulate you to action.

MANIKIN frames in two-tone color combinations: coral on ivory; amethyst on pink pearl; steel blue on powder blue; ivory on bronze; bronze on morocco; morocco on benedictine. All made of a special Nixon cellulose nitrate.

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Founded 1898

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CANADIAN DISTRIBUTOR: CRYSTAL GLASS & PLASTICS, LTD., 130 QUEENS QUAY E., TORONTO, ONTARIO, CANADA

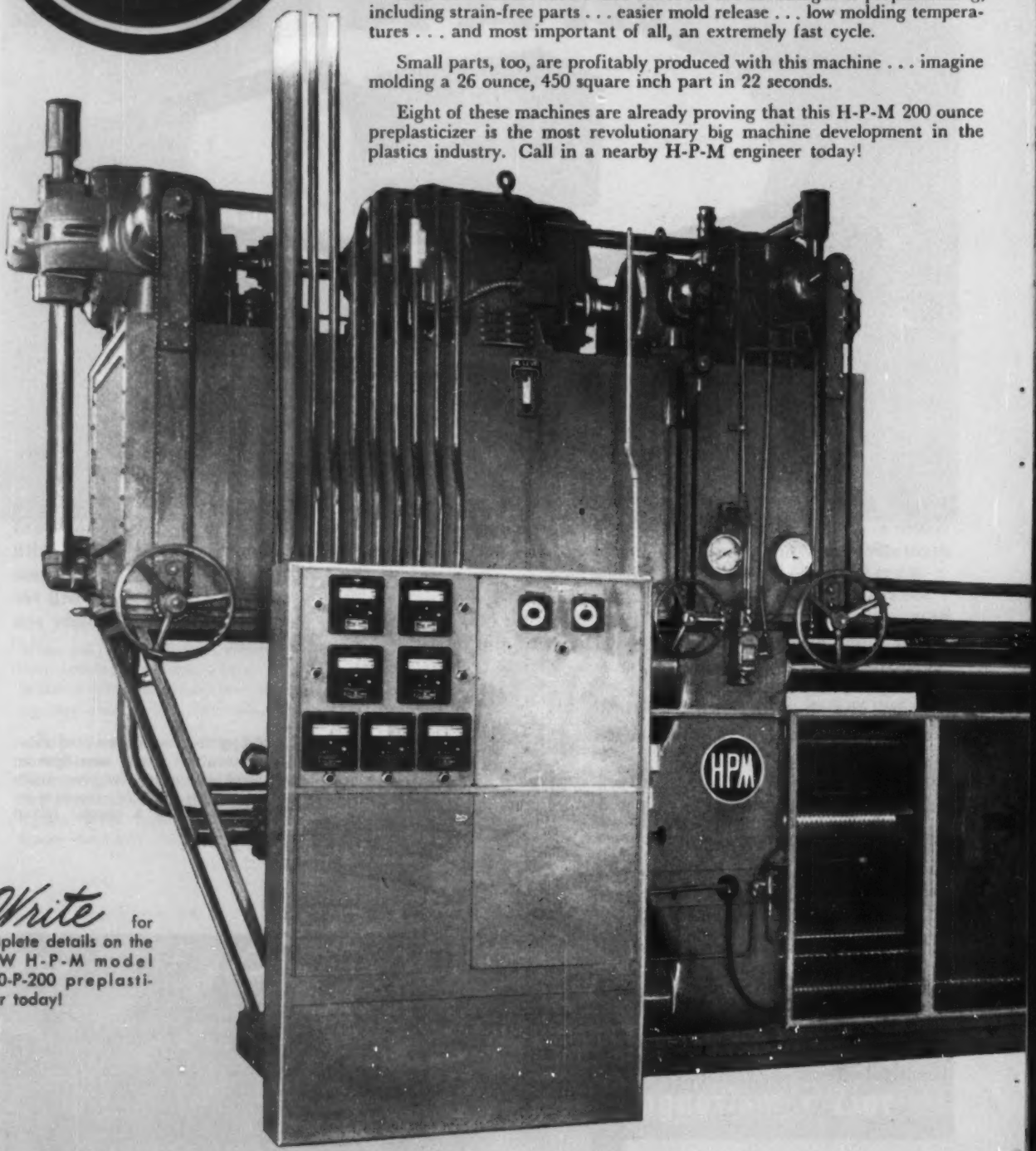
HPM announces NEW

Here is truly the first high-speed, big injection machine ever built! Material is injected into the mold at a rate of 7000 cubic inches per minute. It takes only 3 seconds to inject a 200 ounce "shot" . . . even the huge, 1200-ton mold clamp is faster than most small capacity machines.

This new Model 1200-P-200 offers all the advantages of preplasticizing, including strain-free parts . . . easier mold release . . . low molding temperatures . . . and most important of all, an extremely fast cycle.

Small parts, too, are profitably produced with this machine . . . imagine molding a 26 ounce, 450 square inch part in 22 seconds.

Eight of these machines are already proving that this H-P-M 200 ounce preplasticizer is the most revolutionary big machine development in the plastics industry. Call in a nearby H-P-M engineer today!

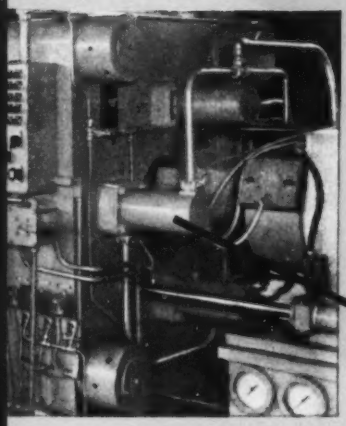


Write for complete details on the NEW H-P-M model 1200-P-200 preplasticizer today!

THE HYDRAULIC PRESS MFG. COMPANY

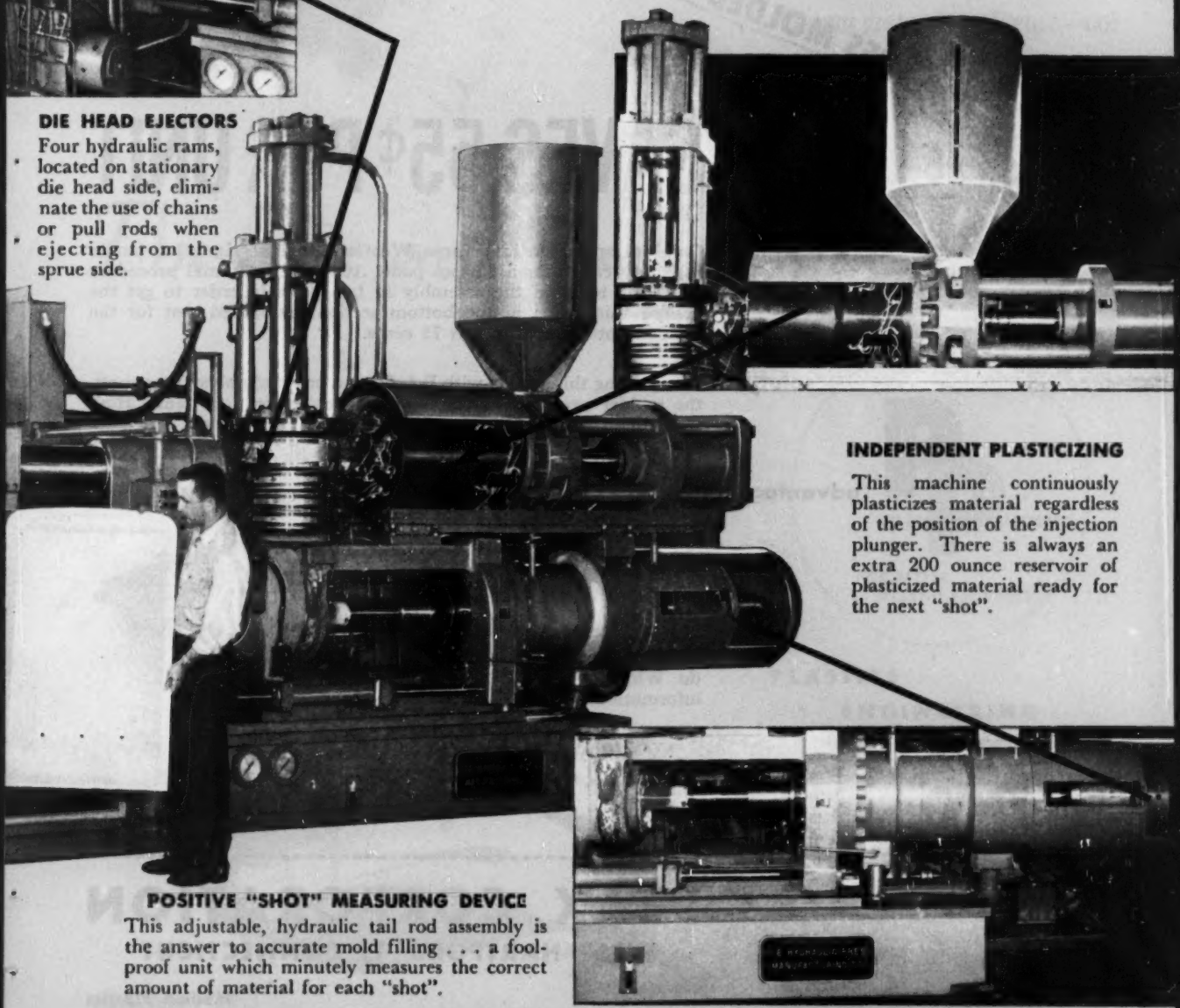
200 oz. preplasticizer

FASTEST Injection Machine Ever Built —



- **Complete Dry Cycle in 10 Seconds**
- **200 Ounces in 3 Seconds**
- **Closes Mold and Develops Full 1200 Tons Clamp Pressure in 3½ Seconds**

DIE HEAD EJECTORS
Four hydraulic rams, located on stationary die head side, eliminate the use of chains or pull rods when ejecting from the sprue side.



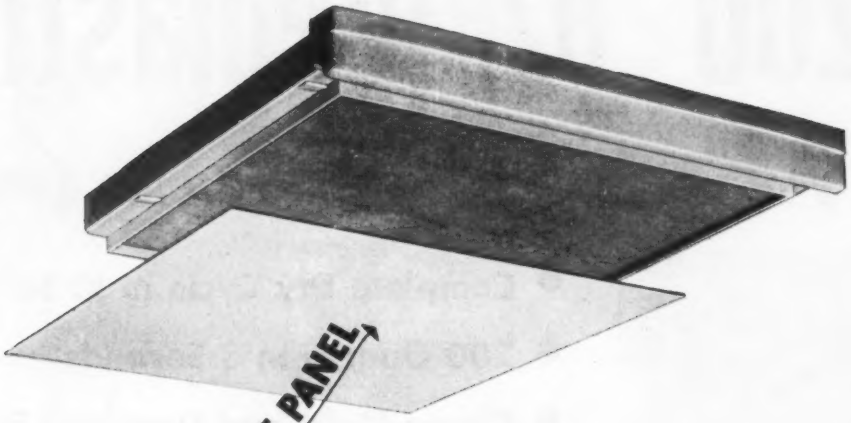
INDEPENDENT PLASTICIZING

This machine continuously plasticizes material regardless of the position of the injection plunger. There is always an extra 200 ounce reservoir of plasticized material ready for the next "shot".

POSITIVE "SHOT" MEASURING DEVICE
This adjustable, hydraulic tail rod assembly is the answer to accurate mold filling . . . a foolproof unit which minutely measures the correct amount of material for each "shot".

1010 Marion Road Mount Gilead, Ohio, U.S.A.

Presses for Every Pressure Processing Need!



POLYFLEX® SHEET REPLACES MOLDED STYRENE PANEL

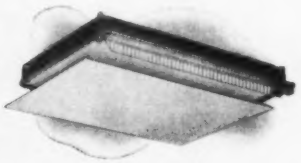
SAVES 55¢ PER UNIT

problem: Original specifications for a Westinghouse refrigerator baffle assembly called for a bottom panel .100″ thick. Normal procedure would be to mold the assembly in two parts in order to get the desired thin panel in the bottom section. Estimated cost for the molded bottom section was 75 cents.

solution: In replacing this section with Polyflex, an oriented polystyrene sheet, the molder provided a tough, thin panel for only 20 cents. High strength of Polyflex permitted use of only .020″ gauge, which reduced weight.

advantages: Ability of Polyflex to conform closely to the contours of the other section provided a more leak-proof assembly. In addition, Polyflex will not warp, twist or shrink in refrigerator temperatures. Water absorption is nil.

Tough, versatile Polyflex is doing things no other sheet plastic can do. Why not write us for complete information?



NOSCO PLASTICS, *division of National Organ Supply Co., Erie, Pa., is the molder who worked out this Polyflex application.*

PLAX

PLAX CORPORATION

WEST HARTFORD 1, CONNECTICUT

A hungry Fox stole one day into a vineyard where many bunches of grapes hung ripe and ready for eating. But as luck would have it, they were fastened upon a tall trellis, just too high for the Fox to reach. He jumped, and paused, and jumped again; but it was all in vain. At last he was fairly tired out, and thereupon, "Take them who will," he cried, "THE GRAPES ARE SOUR!"

—Aesop

No sour grapes from Plenco—our engineers are available to help insure the success of a product from research to application.

The Fox and the Grapes

PLENCO PHENOLICS

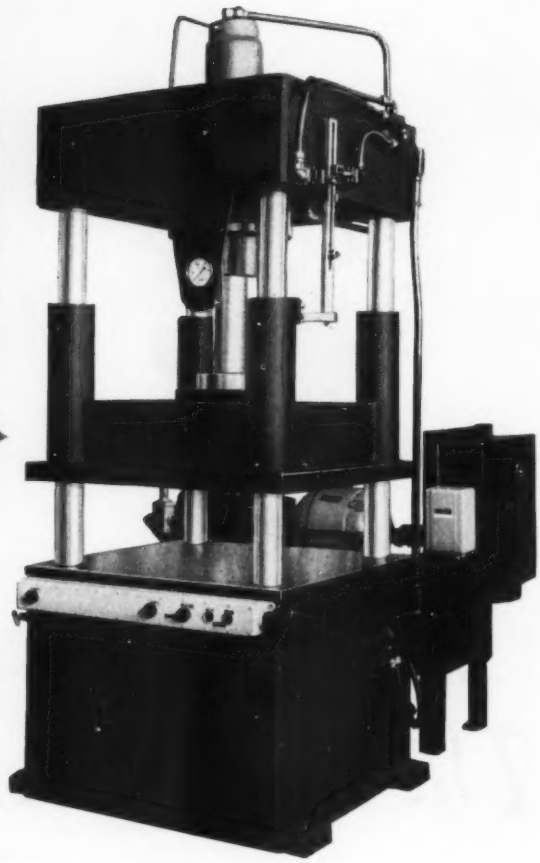
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

DAKE GUIDED PLATEN PRESS

for molding reinforced plastics



Dake Plastics Presses are engineered to the requirements for compression molding of reinforced plastics. Above is illustrated a 75-ton, 4-post double-acting guided platen press, electrically powered and hydraulically operated.

Standard Dake Plastics Presses are equipped with automatic controls which can be arranged so that the ram advances quickly almost to contact—then advances under full power until exactly the desired pressure is exerted on the mold. This pressure is maintained steadily throughout the curing cycle (time interval may be adjusted), after which it is released automatically and the ram returns to starting position.

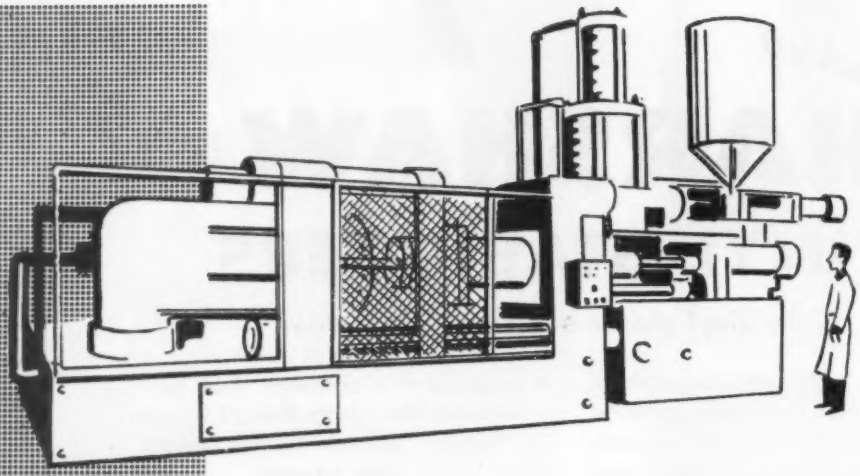
Dake Guided Platen Presses for plastics molding can be engineered to your particular requirements. They are available in capacities up to 300 tons. We will gladly work with you in developing the molding press you need. A letter or phone call will put us to work.

Dake Engine Company, 648 Seventh St., Grand Haven, Mich.

DAKE PRESSES

Arbor Presses · Hand-Operated Hydraulic · Power-Operated Hydraulic · Guided Platen · Gap Type Presses · Movable Frame

CAPACITY

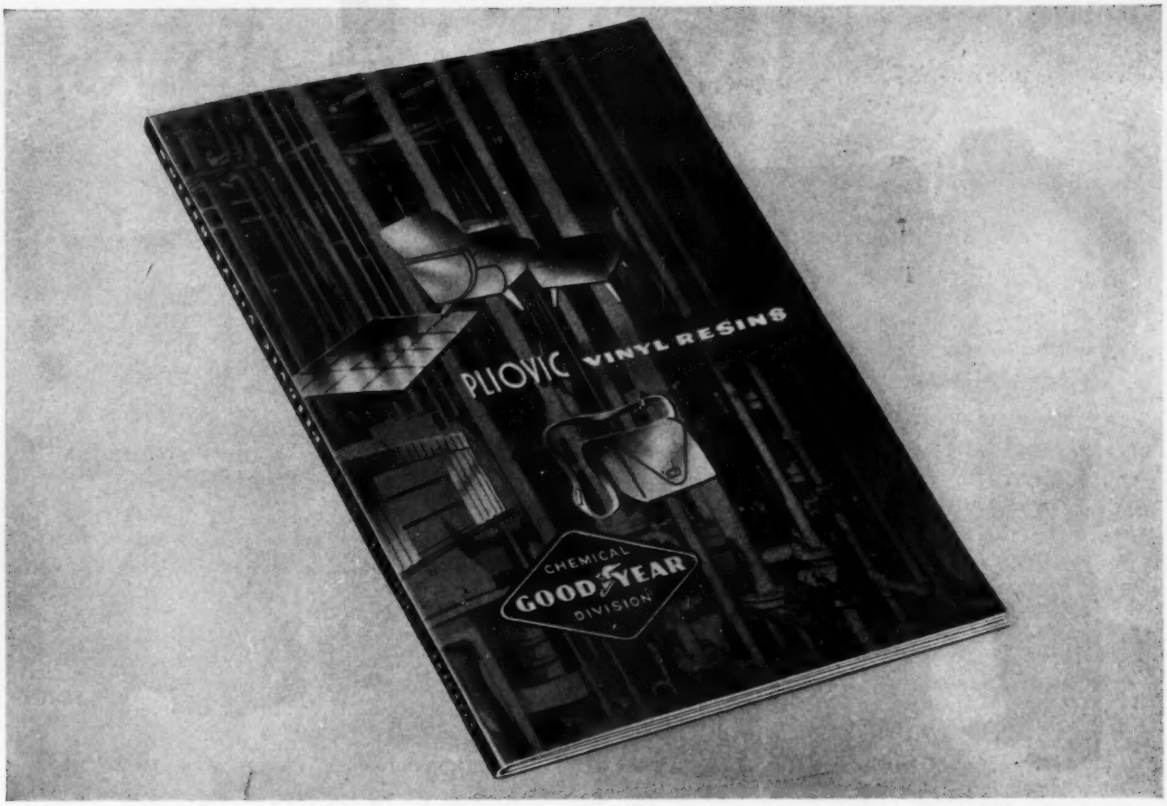


. . . for the ultimate in PLASTIC MOLDING

We have added a new giant injection molding machine to our already complete facilities in order to offer our customers *everything* necessary for finest plastic molding. The new machine has a capacity of 200 ounces and can handle large area moldings with amazing new speed.

If your molding program includes heavy sections with large projected areas, why not check with us. We have the answer to *all* your molding needs.

Bridgeport Moulded Products, Inc.
Bridgeport 5, Connecticut



NEW AID to better vinyl products—IT'S FREE!

HERE'S a big, new help for you toward improving your products made with vinyl resins. It's a factual, 52-page, illustrated, technical manual—just off the press—that gives you full, fast-reading information on PLIOVIC—Goodyear's series of superior polyvinyl chloride resins.

What PLIOVIC is—where to use it—how to compound it—how to process it—what end properties you can expect—these are just some of the important questions answered in this easily read booklet which, incidentally, is but one example of the extra service Goodyear gives you on PLIOVIC.

You will find it well worth while to receive—and read—this informative manual. Just as you find it well worthwhile to sample and use easy processing PLIOVIC in the manufacture of any high quality calendered, extruded or molded product. For the new booklet, samples and full technical assistance, write to:

Goodyear, Chemical Division
Akron 16, Ohio

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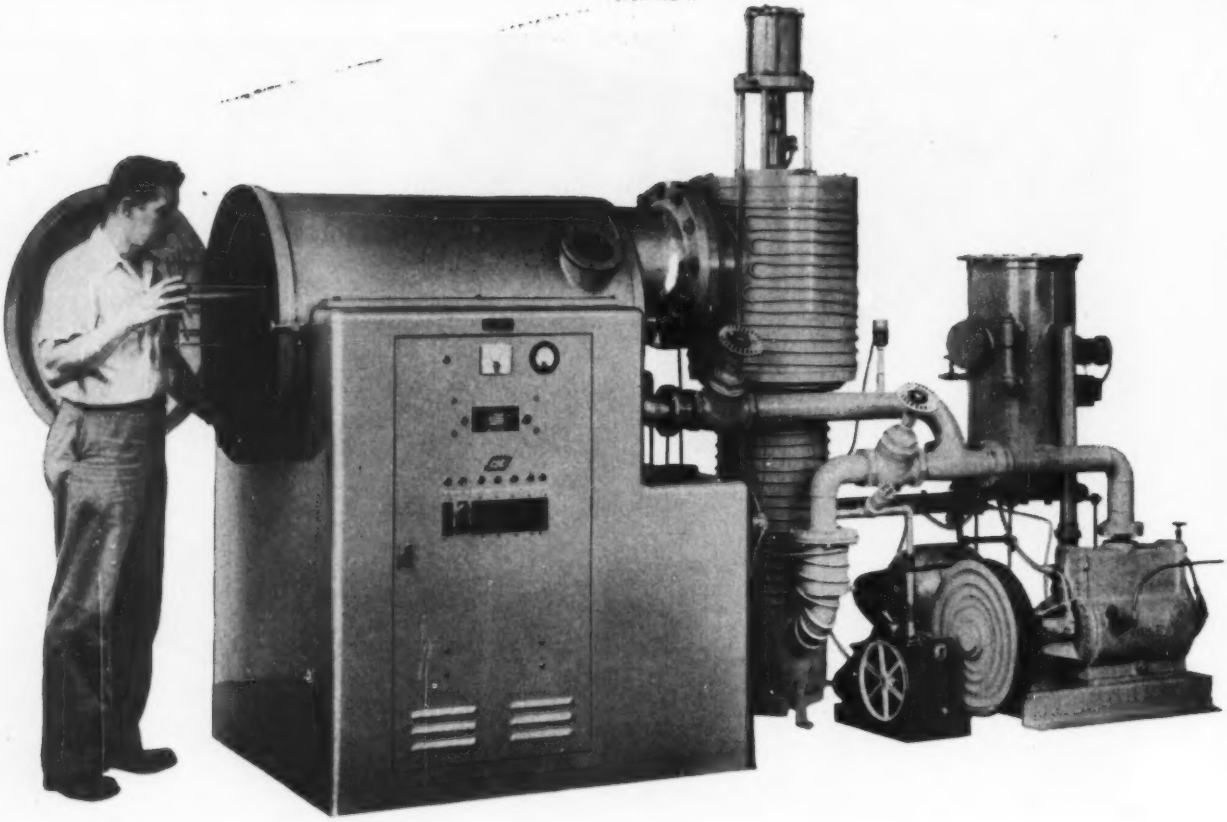


Just right for the small or medium sized finisher...

CVC's new 30-inch high vacuum metallizer

This new *CVC* high vacuum coater, Model LC1-30, was specifically designed to meet the demands for a moderate sized high vacuum metallizing unit.

You don't need to be a high vacuum engineer to set up and operate this new *CVC* coater. It comes complete with all necessary controls—need only be connected to service lines. Here are the details:

- Compact and easy to operate, all cycle switches and valves accessible from one point.
- Simple and inexpensive fixtures are available for either front or second surface coating.
- Two 35-inch long-work holding fixtures will each accommodate over 200 pieces of plastic or metal 1½" in diameter.
- The short cycle time—4 to 5 cycles per hour—gets the work out in a hurry.

If you've been looking for a high vacuum coater that's neither too big nor too small, *CVC*'s Model LC1-30 is your answer. For complete details, write to ***Consolidated Vacuum Corporation, Rochester 3, N. Y.*** (a subsidiary of Consolidated Engineering Corporation, Pasadena, California).

CVC

Consolidated Vacuum Corporation

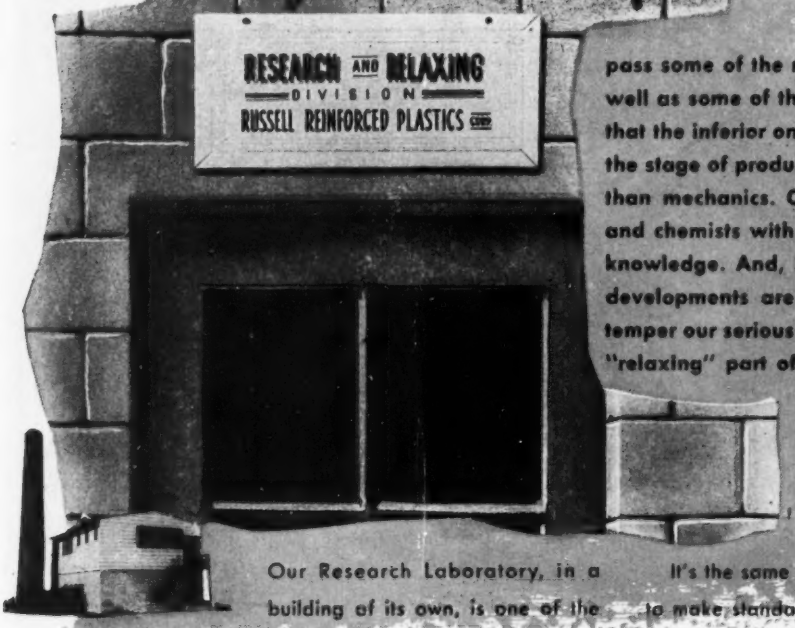
Rochester 3, N. Y.

formerly DPi Vacuum Equipment Dept.

designers and manufacturers of high vacuum equipment

SALES OFFICES: PALO ALTO, CALIF. • CHICAGO, ILL. • CAMDEN, N. J. • NEW YORK, N. Y.

Through this portal

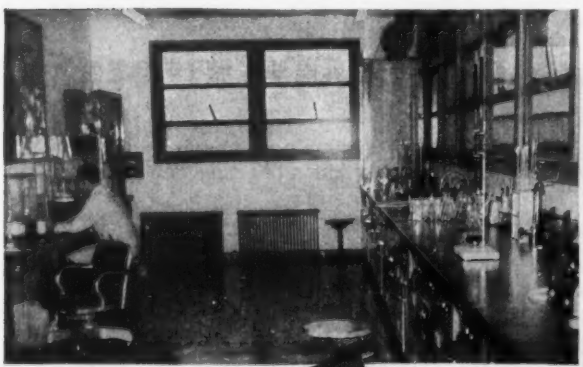


pass some of the most beautiful ideas in plastics . . . as well as some of the most impractical ones. But it is here that the inferior ones are rejected long before they reach the stage of production for at Russell, we are much more than mechanics. Our key men are graduate engineers and chemists with a wealth of practical and theoretical knowledge. And, because we believe that outstanding developments are rarely achieved under pressure, we temper our serious analyses with a dash of humor as the "relaxing" part of our sign will attest.

Our Research Laboratory, in a building of its own, is one of the most modern in any industry. Under the direction of Paul J. Witte, Ph.D., it's the hub of our business. Since ours is a new industry, we are being bombarded constantly with new materials. By test, each is properly evaluated so that when a product goes into production "cut-and-try" procedures are eliminated. Results have been forecast by experts and instruments . . . skilled craftsmen merely follow through without delay.

It's the same story with equipment. We don't try to make standard machines do every job. In fact, though our operation is one of the largest of its kind, the majority of our presses have been designed by our own engineers. This alone is unique in the industry but it enables us to manufacture products much more efficiently and economically.

Ours is a combination that is hard to beat. So, when you have a problem in reinforced plastics . . . in matched die molded parts, flat panels or sandwich construction, we suggest you consult RUSSELL *first*.



Repco Plastics*

by Russell **REINFORCED PLASTICS CORP.**

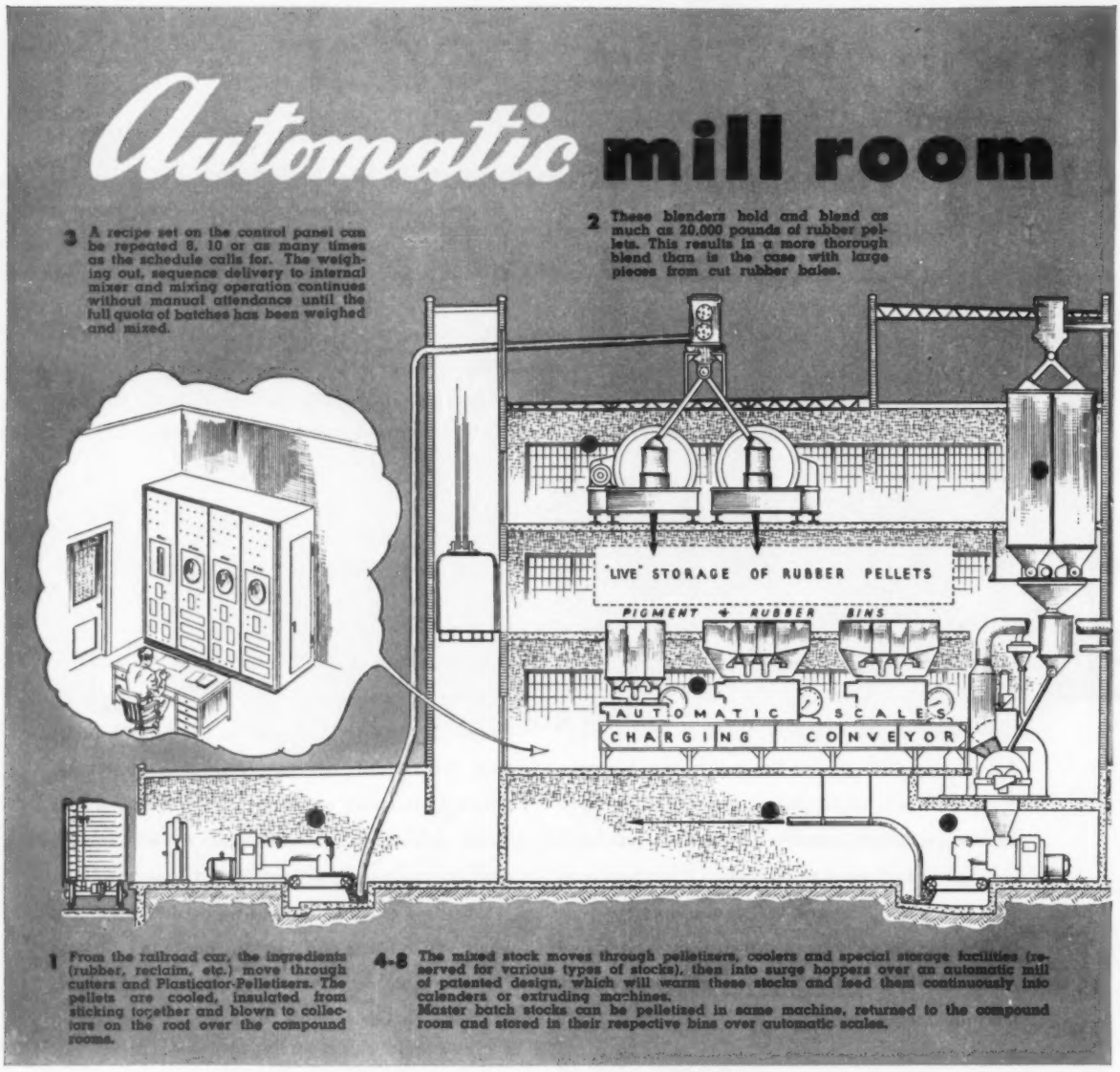
WEST HOFFMAN AVENUE, LINDENHURST, L. I., N. Y.

Lindenhurst 5-1700

*T.M. Reg.

Representatives in LOS ANGELES • KANSAS CITY • TOLEDO • MIAMI • ATLANTA • TORONTO

Automatic mill room



IS THIS FOR ME? WHAT ARE THE ADVANTAGES?

Each succeeding batch or formula can be changed.

New techniques in controls make the change setting of scales as simple as tuning in different stations on your radio. Now, the low volume producer with many kinds of stocks can consider automatic compounding and mixing.

More pounds per hour through the mixing equipment.

If you have a Banbury, the manufacturer has told you how to reduce mixing time. To increase the batches through your Banbury per hour, it is necessary to eliminate the human element which now throttles production.

Automatic scales weigh and deliver ingredients to the Mixer in a few seconds time. Hand scoops, carving knives and hand-set scales are ancient tools. Program controllers operate the Mixer. Pelletizers convert the mixed stock into pellets, which are cooled and blown into special bins. ALL LABOR has been eliminated!

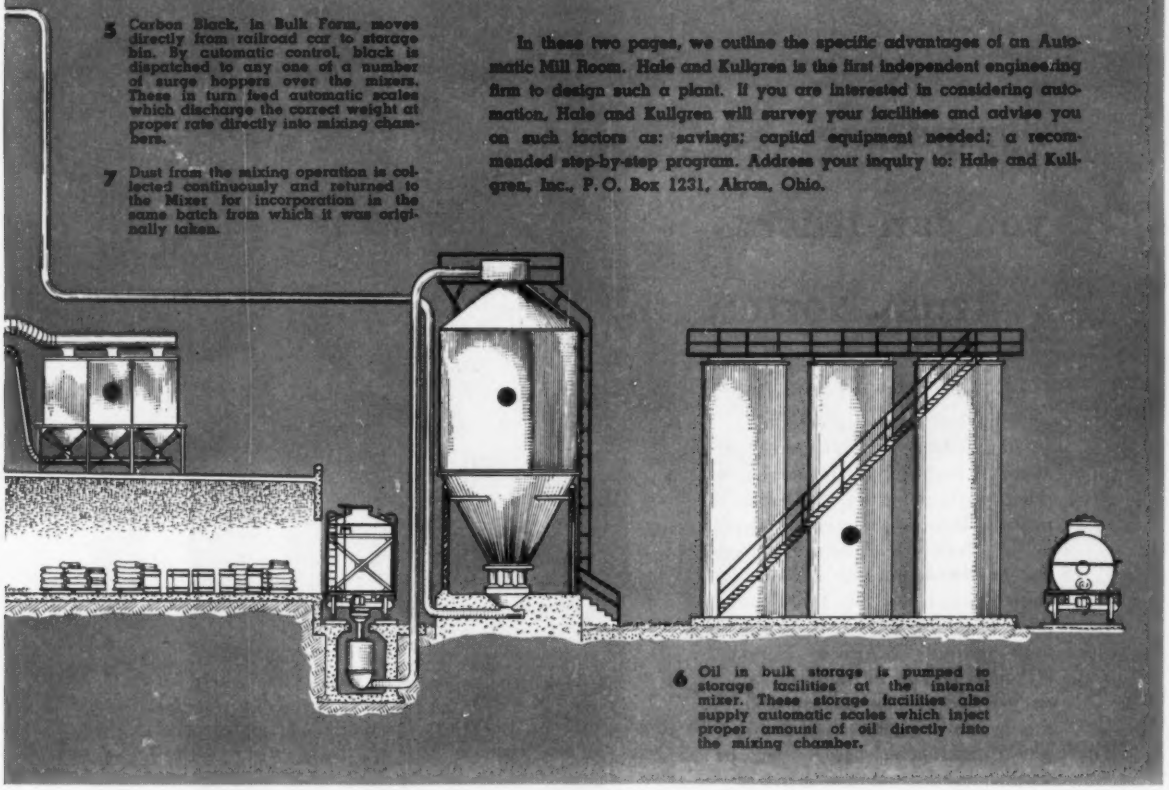
Extruding or Calendering on the "Heavy Side" No Longer Necessary.

Hundreds of thousands of dollars worth of material can be saved yearly by extruding or calendering exact lineal weights. The intimate blending of the raw material and the precise weighing of all ingredients guarantees uniform gravities and physical properties.

Automatic Weighing and Handling of Raw Materials and Mixed Stock

. . . from railway cars to calenders and extruders

In these two pages, we outline the specific advantages of an Automatic Mill Room. Hale and Kullgren is the first independent engineering firm to design such a plant. If you are interested in considering automation, Hale and Kullgren will survey your facilities and advise you on such factors as: savings; capital equipment needed; a recommended step-by-step program. Address your inquiry to: Hale and Kullgren, Inc., P. O. Box 1231, Akron, Ohio.



NE

National Erie products for the Plastic and Rubber Industries • Extruders • Simplex Doors for Autoclaves • Mills and Hydraulic Presses.

This old and well-known line of machinery was acquired March 1, 1952, by The Aetna-Standard Engineering Company. They are manufactured in their Warren, Ohio and Ellwood City, Pa., plants. The sales and engineering of the National Erie line is the responsibility of Hale and Kullgren, Inc., Akron, Ohio.

COMPLETE SERVICE ON RUBBER & PLASTICS
a complete plant : a specialized process : an engineering service or individual machines

SALES and ENGINEERING by
HALE AND KULLGREN INCORPORATED
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MANUFACTURING by
Aetna-Standard
THE AETNA-STANDARD ENGINEERING CO.
PITTSBURGH, PA.
Plants in Warren, Ohio
Ellwood City, Penna.

YOU'LL find it easier to unlock the door to better plasticizer performance when you buy from a single, *basic* plasticizer source.

So call on Pittsburgh PX Plasticizers *first!* From coal to final processing in the company's new and modern plasticizer plant, Pittsburgh PX Plasticizers are quality controlled at every step of production . . . to assure you a product of optimum purity and stability.

And to help you select and apply the right Pittsburgh PX Plasticizers to your production, the assistance of a Pittsburgh Sales Service Representative, *who sells nothing but plasticizers,* is immediately available.

For wide choice, for uniform quality, for prompt, dependable deliveries and for experienced sales service . . . call for Pittsburgh PX Plasticizers.

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Contains useful data on the plastics industry, the role of plasticizers in the industry, and descriptions and recommended applications of Pittsburgh PX Plasticizers. Write for your free copy today!

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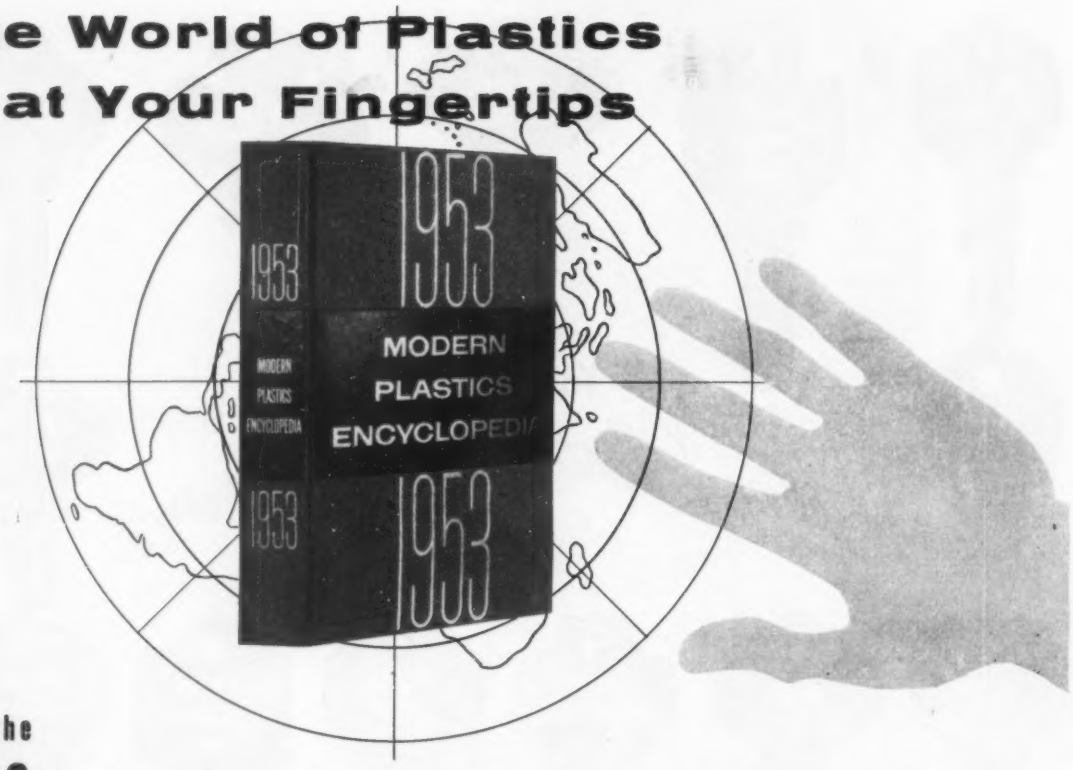

with the

1953 Modern Plastics Encyclopedia & Engineer's Handbook

What are you looking for? Is it a machine? A plastic material? Is it information about a method of processing a plastic? Or the name of a custom molder who can produce fine moldings for you?

In all probability, exactly what you are seeking can be found in your copy of the data-filled MODERN PLASTICS ENCYCLOPEDIA AND ENGINEER'S HANDBOOK.

The 944-pages of the Encyclopedia are arranged and cross-indexed for easy reference. A large quantity of informative advertising plus an extensive Directory Section of suppliers of materials, equipment, and services guide you to qualified sources for all your requirements.

It's handy! It's helpful! It will be to your advantage to get acquainted with the MODERN PLASTICS ENCYCLOPEDIA AND ENGINEER'S HANDBOOK. Like other users, you will find it to be one of the most useful reference works you own.

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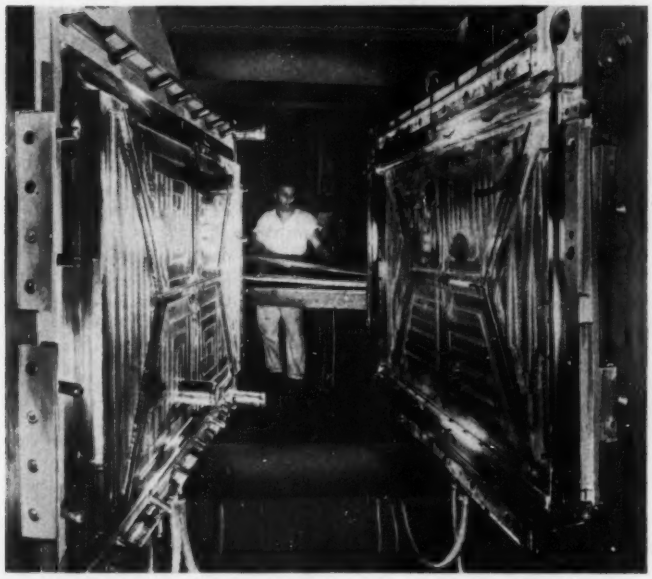
LARGE MOLDS OUR SPECIALTY

Our factory is completely equipped with machining and handling facilities for the best in mold design and construction from the smallest to the largest of molds.



Typical of large molds recently produced by Eagle Tool is the one pictured above. Mold weighed 20,000 lbs.

PART: Freezer trim frame
MOLDER: Panelyte Division St. Regis Paper Company Trenton, N. J.
CUSTOMER: Carrier Corp. Syracuse, N. Y.
STEEL SUPPLIER: Crucible Steel Co. of America
STEEL: CSM 2

This is one of our largest machines capable of cutting mold sections up to 8 feet x 10 feet x 30 inches deep in one setting

WE SUPPLY COMPLETE FACILITIES IN DESIGN AND CONSTRUCTION OF INJECTION, COMPRESSION, TRANSFER, PLUNGER AND LOW PRESSURE MATCHED MOLD APPLICATIONS

EAGLE TOOL AND MACHINE CO.

SINCE 1918

EVANS TERMINAL ROAD, HILLSIDE, N. J.

TELEPHONES: ELIZABETH 4-1515-16

From the monomer headquarters of America

STYRENE
ACRYLONITRILE
VINYL CHLORIDE

Here are low-cost, highly reactive compounds in dependable supply. A laboratory sample may start you toward new profitable products or show you how to obtain a quality advantage over existing products.

If you are in chemical processing—investigate these monomers. They can form addition compounds with virtually all commercial resins and resin formers; they can be your starting point for organic synthesis. What's your business?

Pharmaceuticals?

A whole class of compounds — phenylethanolamines — possessing sympathiometic activity can be synthesized in fair yields in a four-stage synthesis starting with *styrene* to produce N-methylphenylethanolamine or corresponding alkylphenylethanolamines.

Papers?

Cellulose can be cyanoethylated with *acrylonitrile* to produce a transformed cellulose molecule:

ROH + $CH_2 = CHCN \rightarrow R\text{-}O\text{-}CH_2CH_2CN$

Cellulose — Acrylonitrile — Cyanoethylated Cellulose

Cyanoethylated cellulose is stronger, has greater heat resistance, is not attacked by rot or vermin.

TOP QUALITY . . . *all monomers are highest purity, produced in industry's most modern plants, under strict quality control.*

"TIMED SHIPMENTS". . . *deliveries synchronized with your production from five strategically located shipping points. This system can release valuable tank storage space for other use.*

TECHNICAL SERVICE . . . *on storing, handling, inhibiting, analytical procedures, specifications.*

Laboratory-size samples of these reactive monomers will be sent on request. Write MONSANTO CHEMICAL COMPANY, TEXAS DIVISION TEXAS CITY, TEXAS

MONSANTO
CHEMICALS—PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

for every purpose

"Tru-Size" Tubing

CONTINUOUSLY EXTRUDED UP TO 6" DIAMETER

FOR SIGHT GAUGES • VACUUM CLEANER ATTACHMENTS • TOYS • MUSICAL INSTRUMENTS • PACKAGING • RADIO PARTS • CONVEYORS • WATER PIPE • OIL & GAS LINES • PEN & PENCIL BARRELS . . . and many other applications.

What's most important to you in tubing — uniformity, wall strength, color, finish, high precision? Is your problem one with an elusive solution? Then let us tackle it.

Whatever your requirements, Yardley has the engineering skill, production know-how and plant facilities to furnish you the exact tubing you need for every type of end use.

We handle practically every kind of thermoplastic material — rigid or flexible — over 7,000,000 pounds this year. Send for Bulletin 150 — or let our experienced representative near you call now.

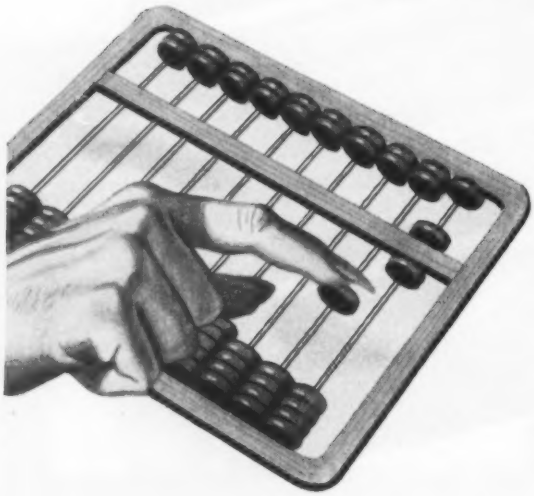
YARDLEY PLASTICS CO.

142 PARSONS AVENUE • COLUMBUS 15, OHIO

IN CANADA: DAYMOND CO., LTD., CHATHAM, ONTARIO

Any way you figure it...

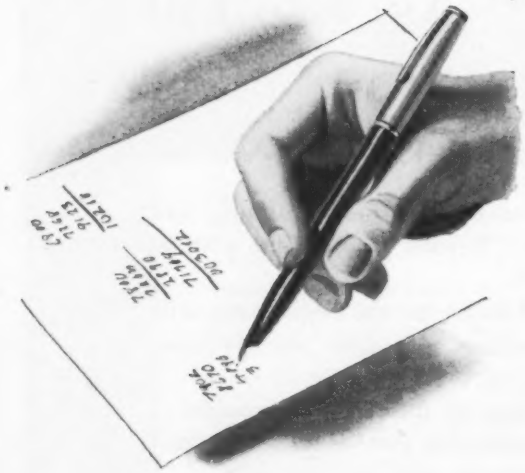
It's the FINISHED COST that counts!



CHLOROWAX® 40 and SURFEX® can be used separately or in combination to lower vinyl compounding costs and increase batch yields with no sacrifice in quality. CHLOROWAX 40 is DIAMOND ALKALI'S liquid chlorinated paraffin which has proved highly satisfactory as a low-cost co-plasticizer. SURFEX is one of DIAMOND'S precipitated calcium carbonates—a reagent extender of high uniformity and purity.

The table indicates how these two DIAMOND chemicals may be applied in vinyl compounding to produce two-way savings. Specific formulas are available through your nearest DIAMOND Sales Office.

Write for your copy of Bulletin No. 4, *The Evaluation of Inert Fillers in Vinyl Plastics.*



	PARTS	
PVC RESIN	100	100
PRIMARY PLASTICIZER	52	47
CHLOROWAX 40	—	15
STABILIZER	3	3
STABILIZER—LUBRICANT	0.5	0.5
SURFEX	—	15
TOTAL	155.5	180.5
ESTIMATED MATERIAL COST LB. VOL.	45.8¢	41.6¢
YIELD— % INCREASE PER LB. OF RESIN		11 (By Vol.)
HARDNESS	85A	85A
TENSILE STRENGTH	2600 psi	2600 psi
ELONGATION	375%	375%
100% MODULUS	1400 psi	1400 psi
CRESCENT TEAR	375 lbs. in.	375 lbs. in.
BRITTLENESS—TEMPERATURE	−31°C	−29°C
HEAT LOSS	5.5%	4.7%

DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis and Houston. Also, representatives in other principal cities.

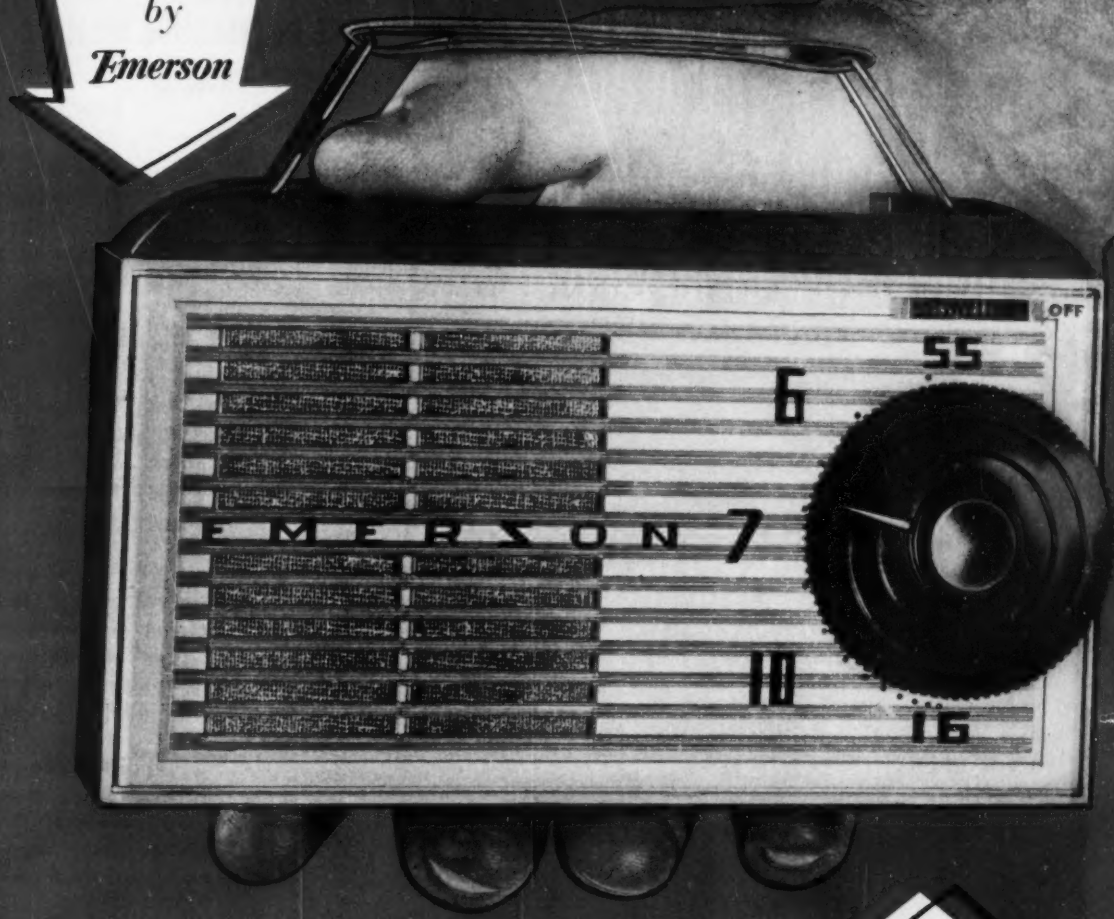
DIAMOND DISTRIBUTORS: C. L. Duncan Company, San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U.S.A.; Harrisons & Crosfield, (Canada) Ltd.

DIAMOND CHLOROWAX 40 AND SURFEX

DIAMOND ALKALI COMPANY • CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS®

TINY RADIO *by* ***Emerson***



Public acceptance of Emerson Radio and Phonograph Corporation's engineering miracle, the "Pocket Radio," has been nothing short of spectacular. This world's smallest personal portable, measuring only six inches in width by one and a quarter inches in depth and weighing less than one pound, is housed in a striking impact styrene case, injection molded by Ideal Plastics.

Not only was Ideal able to provide the cases and other molded components needed initially, but now that consumer demand has really started snow-balling, our vast custom injection molding facilities are proving equal to every demand for more and faster production.

It is typical for critical purchasers with large requirements to call on Ideal to fill their needs for molded plastics. You will find that we handle every aspect of your custom injection molding in a manner and at a price which will please you.

For a prompt estimate, contact A. C. Manovill, Vice President in Charge of Sales. Ideal Plastics Corporation, 184-10 Jamaica Avenue, Hollis 7, N. Y. Phone: Axtel 3-7000. Midwest Representative, Steel Mill Products Co., 176 West Adams St., Chicago 3, Ill. Phone: CEntral 6-5136.

Better Molded Plastics for Industry & Home

BIG JOB *by*

Ideal

Plant Manager Ed Campi Reports:

"... best preform press on the market for high production of large pills."

THE INTERNATIONAL MOLDED PLASTICS PROBLEM:

To maintain the high quality of their dinnerware, International Molded Plastics, Inc., depends upon obtaining very accurate weight, density and dimensions in preforming melamine formaldehyde.

THE BALDWIN SOLUTION:

Edward Campi, Plant Manager of International Molded Plastics, Inc., Cleveland, explains how three Baldwin Model #20 Preform Presses have solved their threefold problem:

1. **"Inaccurate weight pills are costly because flash and rejects are a total loss. By holding preform weight as accurate as possible with production speeds that are necessary, our Baldwin press has reduced rejects greatly.**

2. **"Melamine formaldehyde requires eight to ten tons p.s.i. to give preforms of satisfactory hardness. Only the Baldwin-Defiance press meets these specifications to our satisfaction.**

3. **"We can prewarm electronically several preforms uniformly at one time because the Baldwin-Defiance machine makes preforms of uniform thickness."**

Mr. Campi reports a further benefit: "Not only can we make a die change in fifteen to twenty minutes, but also the Baldwin press is constructed without exposed gears or other working parts which would make it difficult to clean . . . a major problem in manufacturing pastel and dark shades of dinnerware."

WHAT'S YOUR PRESSING PROBLEM?

For help in solving any of your compacting problems, write for Bulletin 323 to Dept. 4326, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

General Offices: Philadelphia 42, Pa. • Offices in Principal Cities

Refrigerator and Freezer Parts

Leading manufacturers in the refrigeration industry have long depended on ERIE for important plastic parts. For they have learned that ERIE knows plastic materials and knows how to mold and finish them. The pioneer in custom injection molding has had a longer experience in meeting practical problems than any other manufacturer in the field.

Plastic parts by ERIE include appetizing food trays, large and small, deep and shallow; interior compartment doors that combine beauty with utility; panels, handles, knobs, and name plates in three-dimensional plastics that glamorize the product and captivate the prospect.

Write for your copy of bulletin,
"Who We Are . . . What We Do in Plastics"

25th Anniversary

ERIE

ERIE RESISTOR CORPORATION . . . PLASTICS DIVISION

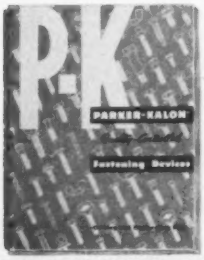
Main Offices: **ERIE, PA.**

Sales Offices: Cliffside, N. J. • Philadelphia, Pa. • Buffalo, N. Y. • Chicago, Ill. Detroit, Mich. • Cincinnati, Ohio • Los Angeles, Calif.

Factories: **ERIE, PA. • LONDON, ENGLAND • TORONTO, CANADA**

"Speeds up and simplifies our product design job . . . helps us make sure our planned assembly savings pay off."

P-K CATALOG AND ENGINEERING DATA



Illustrates and describes all P-K products. Tells "where, when, how, and why" P-K Fasteners are used. Shows many typical applications. Gives all needed information for selection and application . . . 88 pages.

P-K SELF-TAPPING SCREW BULLETIN

A 48-page separate edition of the Self-tapping Screw section of the General Catalog.

P-K ENGINEERING STANDARDS BOOK

A 64-page book of standard head and thread dimension drawings of P-K Screws, other useful data.

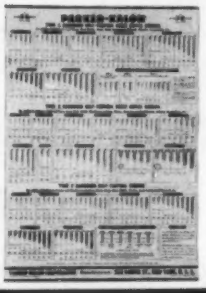
P-K SOCKET SCREW BULLETIN

A 16-page separate edition of the Socket Screw section of the General Catalog.

POWER DRIVING BULLETIN

Describes and illustrates the various basic types of electric, air-operated, and impact tools for driving P-K Screws, as well as hopper-fed automatic driving machines in common use. Includes useful information on bit and socket selection.

P-K SCREW SIZE WALL CHART



Wall hanger, 18" x 24", illustrates in actual sizes all standard P-K Self-tapping Screws and other Fasteners.

SOCKET SCREW DIMENSION FINDER

Pocket-size plastic slide chart gives essential dimensions of all types of P-K Socket Screws at a glance, including thread length formula.

STAPS FOLDER

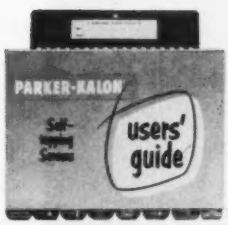
Describes the characteristics of Parker-Kalon STAPS and their primary applications. Shows various forms of pre-assembled neoprene washers available.

"HOW TO MAKE PLANNED SAVINGS PAY OFF" BOOKLET

A 24-page condensed catalog of P-K Self-tapping Screws explains P-K quality control. Pocket-size, and packed with information.

PARKER-KALON®
Assembly Planning Aids and Engineering Service

USERS' GUIDE



Plastic bound, 20-page index-tabbed 11½" x 9" work-book of technical information on selection and application of P-K Screws. Has "hang-up" tab. Popular with designers, engineers, and draftsmen for quick reference.

"HOW TO USE" BOOKLET

Pocket-size booklet of hole-size recommendations and other application information. Useful for quick reference by assembly supervisors.

FOLDERS ON INDIVIDUAL PRODUCTS

Screwnails, Masonry Nails, and other P-K products and services are described in folders which point out primary uses.

ASSEMBLY PLANNING AIDS Originator and largest producer of Self-tapping Screws, and pioneer in the development and improvement of other P-K fasteners, Parker-Kalon is a leading authority on assembly engineering. Through long experience in working closely with designers, product engineers, and others responsible for fastener selection, P-K has prepared technical literature exactly keyed to your needs. It is published in various forms planned to save reference time, yet provide all required information.

ASSEMBLY ENGINEERING SERVICE Parker-Kalon field representatives are fully-qualified Assembly Engineers. They can advise you how to plan assemblies to save fastening time, add product strength, and lower costs. When required, the modern facilities of a completely equipped laboratory in the P-K plant are available for testing new applications, and detailed reports will be furnished for your guidance.

Since Parker-Kalon offers a complete line, the P-K Assembly Engineer's recommendations for Self-tapping Screw selection are unbiased. The P-K method fits the *right* screw to the job.

Ask your local P-K Distributor for the P-K literature you need. If desired, he'll arrange for a P-K Assembly Engineer to call. Or write: Parker-Kalon Corporation, 200 Varick St., New York 14.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**

Cold-forged **SOCKET SCREWS**

AND OTHER FASTENERS

FIBER PG GLASS

Help's make plastics better safer lighter stronger

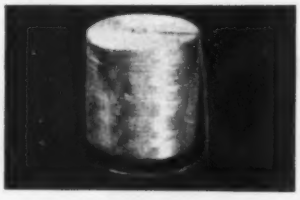
The basis of all Pittsburgh Fiber Glass products is a continuous filament of glass. Pittsburgh controls the diameters of these filaments to a high degree of fiber uniformity. Packaging is also closely controlled. The manufacturer of fiber glass reinforced plastics thus obtains these advantages:

- Specifications for reinforcing cloth can be adhered to more easily by weavers using Pittsburgh Yarns.
- Roving is packaged with a uniform tension that improves automatic feeding in preform operations. It also is a desirable factor when used for such products as bar stock and fishing rods.

You are invited to obtain complete information, including the names of weavers using Pittsburgh Yarns. Pittsburgh Plate Glass Company, Fiber Glass Division, 420 Fort Duquesne Boulevard, Pittsburgh 22, Pa. District Sales Offices: Chicago, Cincinnati, Cleveland, Detroit, New York, Washington.

Roving packaged to meet your needs

In addition to standard 35-pound, 60-ends packages, Pittsburgh Roving is also supplied in 12-ends and 24-ends; on special order, in any number of ends up to 60. Either inside or outside winding is available.

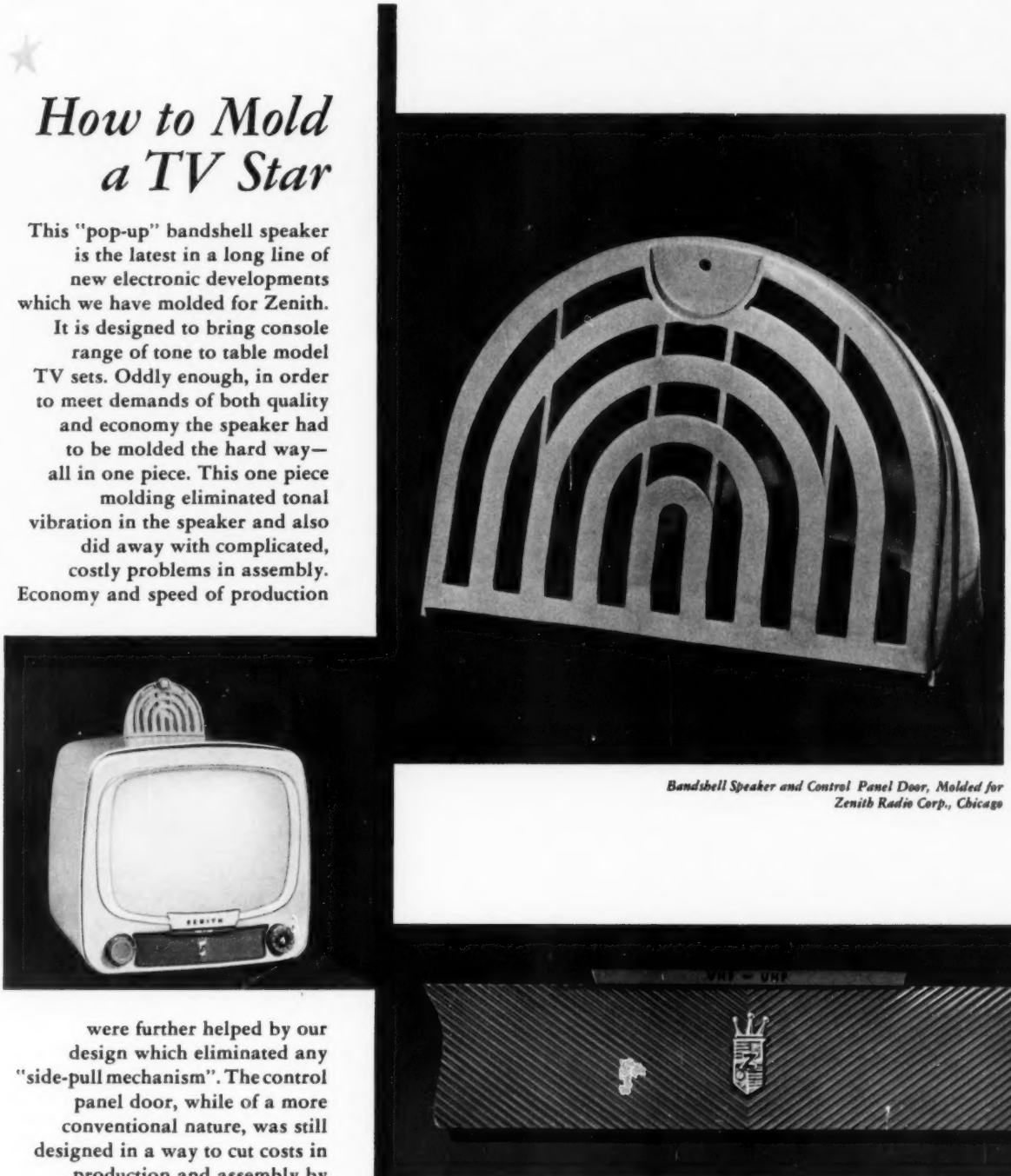


FIBER PG GLASS PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

How to Mold a TV Star

This "pop-up" bandshell speaker is the latest in a long line of new electronic developments which we have molded for Zenith. It is designed to bring console range of tone to table model TV sets. Oddly enough, in order to meet demands of both quality and economy the speaker had to be molded the hard way—all in one piece. This one piece molding eliminated tonal vibration in the speaker and also did away with complicated, costly problems in assembly. Economy and speed of production were further helped by our design which eliminated any "side-pull mechanism". The control panel door, while of a more conventional nature, was still designed in a way to cut costs in production and assembly by having the screw holes pulled right in the mold. We believe we can show you how to make the skillful use of plastics play a similarly starring role in your product's sales picture. May we audition for you without obligation soon?



Bandshell Speaker and Control Panel Door, Molded for Zenith Radio Corp., Chicago

Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about [redacted]*, piping, tubing and fittings, write for circulars containing data and illustrations.*

*Trade Mark Reg.

ELMER E. MILLS CORPORATION

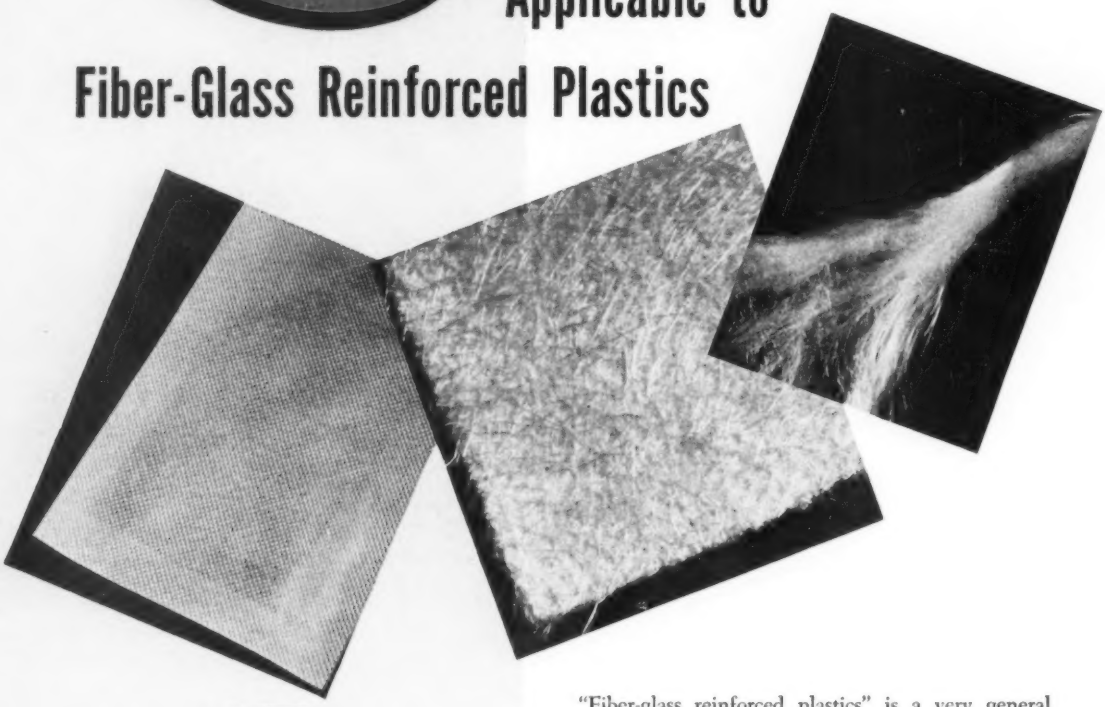
a subsidiary of

CONTINENTAL CAN COMPANY

INJECTION MOLDED and EXTRUDED Thermo-Plastic Materials Including Cellulose Acetate, Cellulose Acetate Butyrate, Acrylates, Methacrylates, Styrenes, Vinyls, Vinylidene Chloride, [redacted] *

2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

Look to MPc for All Production Techniques Applicable to Fiber-Glass Reinforced Plastics



"Fiber-glass reinforced plastics" is a very general term, applied to a broad range of materials with the most diverse properties...and therefore suited to the most amazing variety of applications.

To begin with, fiber-glass itself is available in many forms...as cloth of various weaves, as loosely woven mat, or as rovings. These materials can, in turn, be impregnated with many formulations of the phenolic, the melamine or polyester resins.

Production techniques also vary widely. Short production runs can be economically produced by means of temporary molds. For large quantities matched metal molds can be employed with either high pressure or low pressure molding. Complex shapes can be molded in two or more pieces to reduce tooling costs. The separately molded pieces are then joined with an adhesive which makes the joint as strong as the molded material itself.

All of these various possibilities come within the scope of **MPc** facilities. Look to **MPc** for help with your advance thinking on fiber-glass reinforced plastics. **MPc** will assist you in developing specifications and making the necessary engineering calculations. Extensive laboratory facilities are yours to use in making all tests required for your product. Address your inquiry to MOLDED PRODUCTS, 4535 W. Harrison St., Chicago 24, Ill.

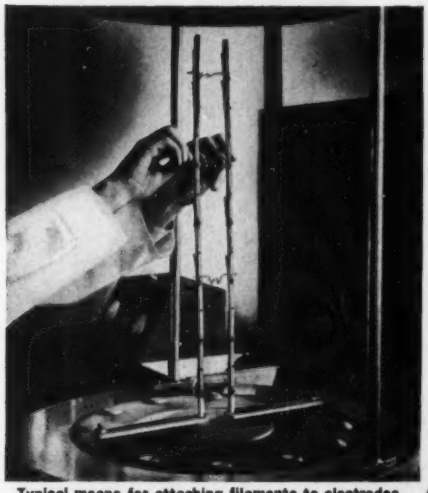
MOLDED MPc PRODUCTS

DIVISION OF
ADMIRAL DISTRIBUTORS, INC.

...Pace-Makers in Plastics Molding

MEMBER: COMMITTEE ON LARGE PLASTIC MOLDINGS OF THE SPI

Sylvania Tungsten Coils



Typical means for attaching filaments to electrodes.
Photograph courtesy of Distillation Products Industries ©

for high-vacuum coating

Sylvania custom made tungsten coils assure highest performance at lowest cost

Sylvania either has a tungsten coil or will design one for your particular need. We have the facilities and engineering know-how to supply you with the right coil for any job.

Here's why Sylvania Tungsten Coils save you money:

- You can count on certainty of operation in each cycle.
- They provide a uniform deposit of metal where you want it.
- They reduce mechanical breakage in loading of filaments.
- You get more shots from each filament and best heat for evaporation.

Sylvania offers a complete line of efficient ready made coils. Each of these high grade tungsten filaments is designed for a specific job. Each has the most efficient section and surface area to assure you excellent performance . . . at the lowest cost.

If you make your own tungsten coils, Sylvania can supply you with the highest quality tungsten wire—single or multiple strand, as well as expert design assistance.

For full information write for the free Sylvania Brochure 3T-5011, Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

SYLVANIA

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In Canada: Sylvania Electric (Canada) Ltd.
University Tower Building, St. Catherine Street, Montreal, P. Q.

REXWELD extends SERVICE LIFE of Hartig extruder feed screws by 400%

Here is a typical case of how REXWELD Hard Surfacing Rods are used to extend tool and product life . . . to provide a better, crack and porosity free surface that wears longer.

One of the most important parts of the plastic extrusion machines made by the Hartig Engine and Machine Company is the *feed screw*. This part propels heated plastic through an extrusion die under great pressures, and at rates as high as 2000 pounds per hour. Because the slightest amount of wear on the screw is so critical — on some jobs more than 0.010″ means replacement — Hartig hardfaces them with REXWELD C by the oxyacetylene process.

The Hartig people have found that REXWELD C extends the life of the screws 400% over unsurfaced screws . . . provides a surface that resists abrasion and corrosion . . . and gives them a dense facing free from surface imperfections — an important factor from the standpoint of product contamination.

Next time you have a hard surfacing job which requires the best in service life and ease of application, ask for REXWELD Hard Surfacing Rods. They are available in many different grades and sizes, and in electrodes bearing the special REXWELD low hydrogen coating.

CRUCIBLE

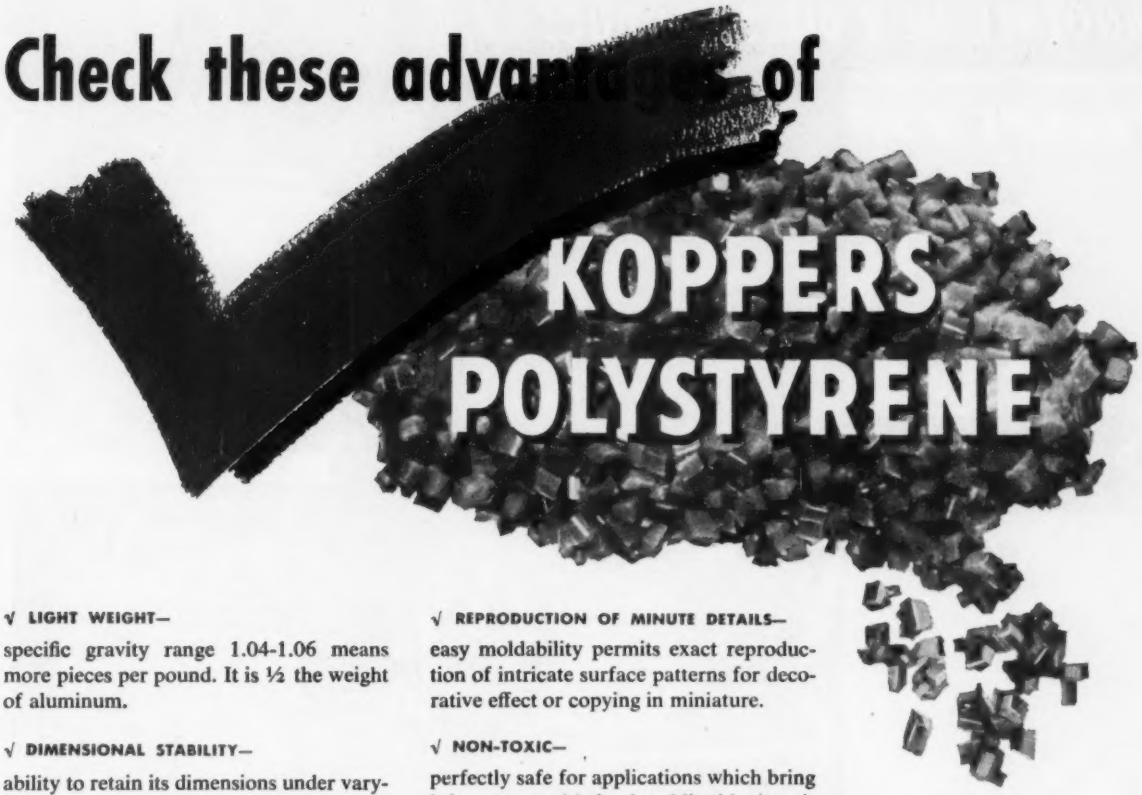
53 years of Fine steelmaking

REXWELD HARD SURFACING ROD

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REZISTAL STAINLESS • REX HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

Check these advantages of



√ LIGHT WEIGHT—

specific gravity range 1.04-1.06 means more pieces per pound. It is ½ the weight of aluminum.

√ DIMENSIONAL STABILITY—

ability to retain its dimensions under varying temperatures, humidity and load conditions.

√ UNLIMITED COLORS—

Koppers Polystyrenes are made in crystal-clear transparent or in any desired color. Color-matching equipment of the latest design assures accurate matching of colors.

√ CHEMICAL RESISTANCE—

resists all concentrations of most acids and alkalies.

√ ELECTRICAL PROPERTIES—

highest in dielectric strength, lowest dielectric constant, lowest power factor of all rigid thermoplastics.

√ RELIABLE UNIFORMITY—

strict control over all raw materials, plus a unique production process, enables Koppers to make polystyrene of unequalled uniformity.

√ REPRODUCTION OF MINUTE DETAILS—

easy moldability permits exact reproduction of intricate surface patterns for decorative effect or copying in miniature.

√ NON-TOXIC—

perfectly safe for applications which bring it in contact with food and liquids since it will not affect them in any manner. Hard, non-porous surface can be easily and thoroughly cleaned.

√ NON-SHATTERING—

accidental breakage does not produce dangerous slivers or sharp edges capable of cutting.

√ PLEASANT TO THE TOUCH—

smooth surfaces of Koppers Polystyrene do not irritate the skin or nerves, give a pleasant, "warm" feeling when handled.

√ LOW COST—

no other basic material has the unique combination of desirable characteristics inherent in Koppers Polystyrene at such low cost. Uniform high quality assures a minimum of rejects and additional low unit costs.

Write for further information on Koppers Polystyrenes and Modified Polystyrenes.

KOPPERS POLYSTYRENES

Type 3	General Purpose Polystyrene
Type 7	Improved Heat Distortion Temperature
Type 8	Highest Heat Distortion Temperature
MC-185	High Impact, Lowest Water Absorption Rate
MC-301	High Impact, Improved Heat Distortion Temperature
MC-305	High Impact, Easy Flow
MC-309	High Impact, Highest Heat Distortion Temperature
MC-401	Medium Impact, Improved Heat Distortion Temperature
MC-405	Medium Impact, Easy Flow
MC-409	Medium Impact, Highest Heat Distortion Temperature

Koppers Plastics Make Many Products Better and Many Better Products Possible.

KOPPERS

Koppers Plastics

Guaranteed by Good Housekeeping

KOPPERS COMPANY, INC., Chemical Division, Dept. MP-113, PITTSBURGH 19, PENNSYLVANIA

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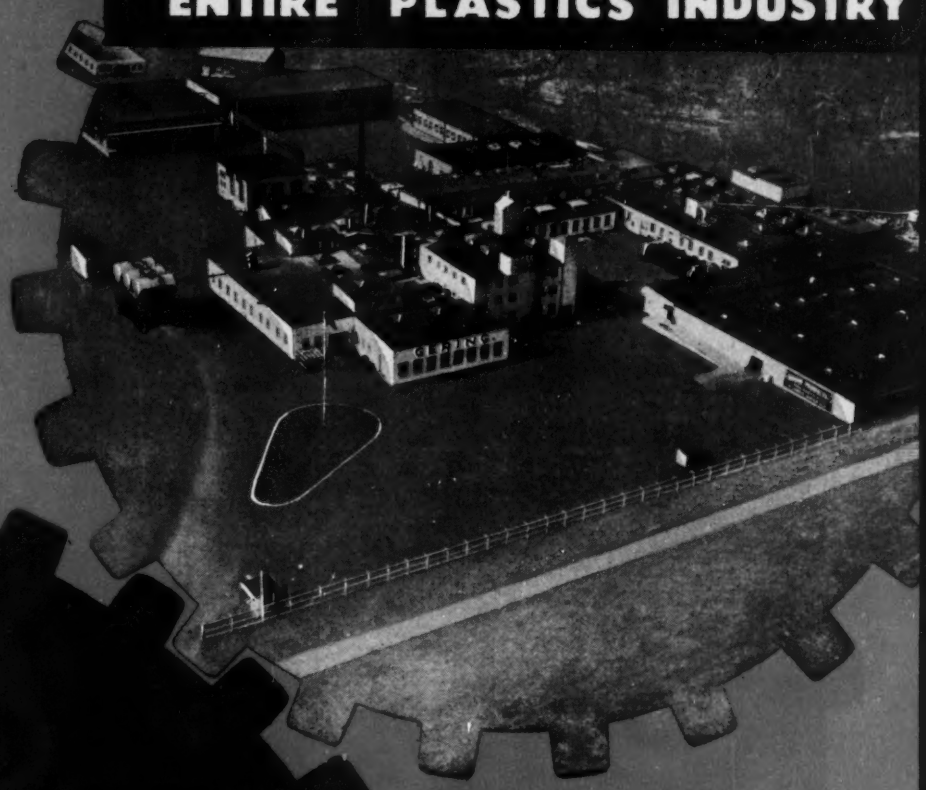
Gering is Geared TO SERVE THE ENTIRE PLASTICS INDUSTRY

a complete **PLANT**

for a complete **SERVICE**

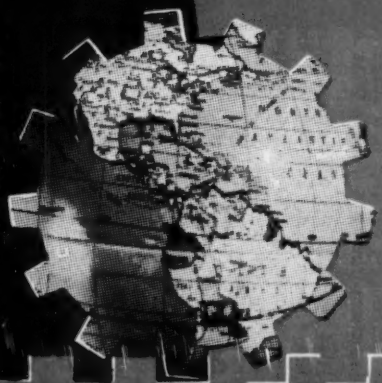


WE MANUFACTURE Virgin Thermoplastic injection and extrusion molding compounds, standard and special formulations . . . Polystyrene, Polyethylene, Acetate, Acrylics, Ethyl Cellulose, Vinyls.

- **WE BUY THERMOPLASTIC SCRAP** — all types and forms: Polystyrene, Vinyls, Nylon, Ethyl Cellulose, Polyethylene, Acetate, Butyrate, Acrylics.
- **WE CUSTOM COMPOUND** your materials, and offer these special services: Sorting, De-contaminating, Color-Matching, Pelletizing.
- **WE EXTRUDE** any flexible or rigid formulation which you plan, for any special-shaped Belting, Binding, Edging, Rods, Tubes, Film, Strips . . . in Polystyrene, Cellulose Acetate, Polyethylene, Vinyl, Butyrate, Ethyl Cellulose, Acrylics.

DRYCOL —offered as Gering's perfected dry coloring medium for in-plant coloring of ALL PLASTICS. No special skill or equipment needed. Standard, Special and Metallic colors available or to order.

Take advantage of our 31 years of know-how and flexible facilities which are geared to your demands



GERING *Products* INC. KENILWORTH, N. J.

The **Windsor** SINGLE STAGE MULTI-SCREW

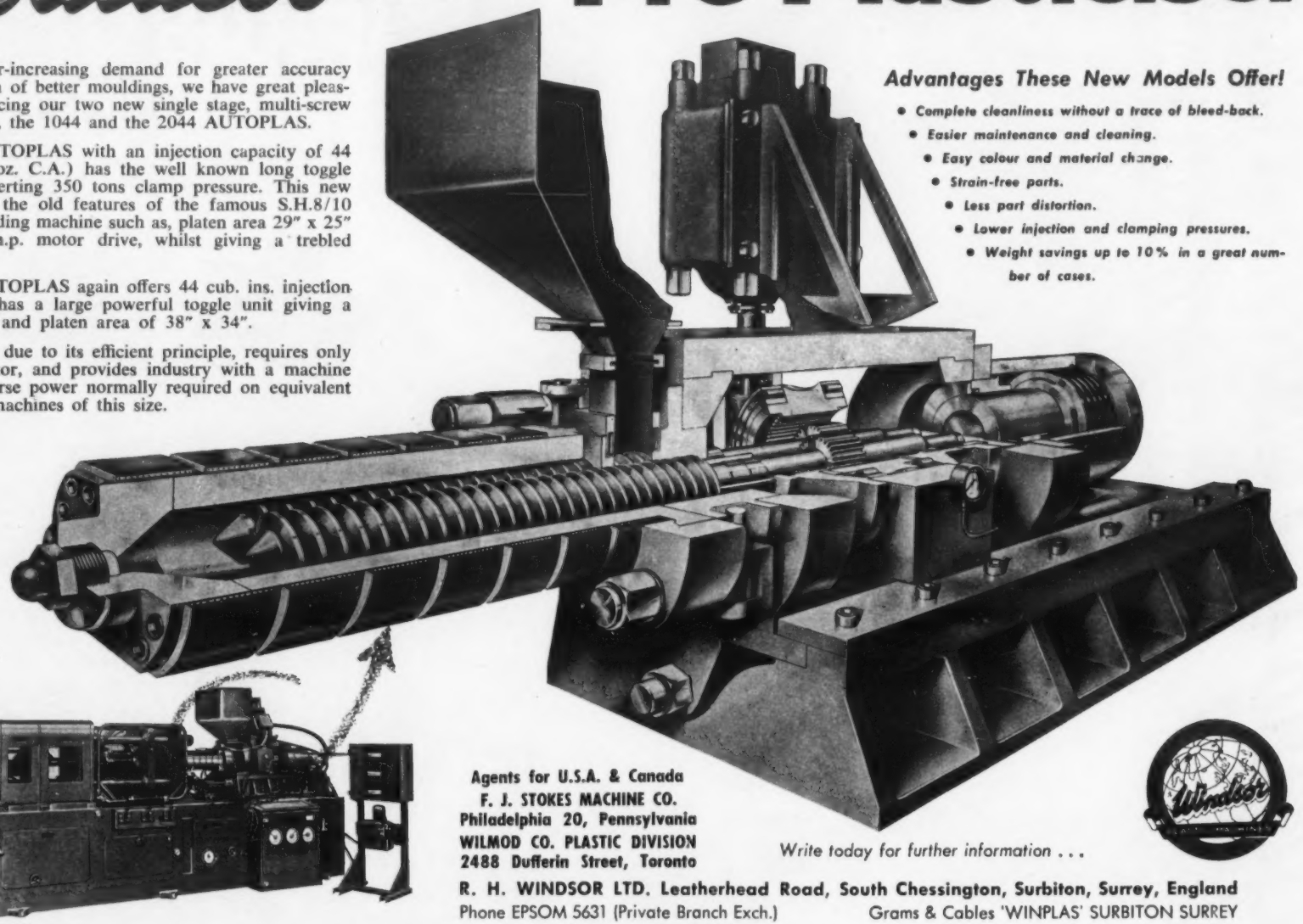
Pre-Plasticiser

With the ever-increasing demand for greater accuracy and production of better mouldings, we have great pleasure in introducing our two new single stage, multi-screw pre-plasticisers, the 1044 and the 2044 AUTOPLAS.

The 1044 AUTOPLAS with an injection capacity of 44 cub. ins. (32-oz. C.A.) has the well known long toggle mechanism exerting 350 tons clamp pressure. This new model retains the old features of the famous S.H.8/10 injection moulding machine such as, platen area 29" x 25" and the 25 h.p. motor drive, whilst giving a trebled capacity.

The 2044 AUTOPLAS again offers 44 cub. ins. injection capacity, but has a large powerful toggle unit giving a 600 ton lock, and platen area of 38" x 34".

This machine, due to its efficient principle, requires only a 25 h.p. motor, and provides industry with a machine at half the horse power normally required on equivalent conventional machines of this size.



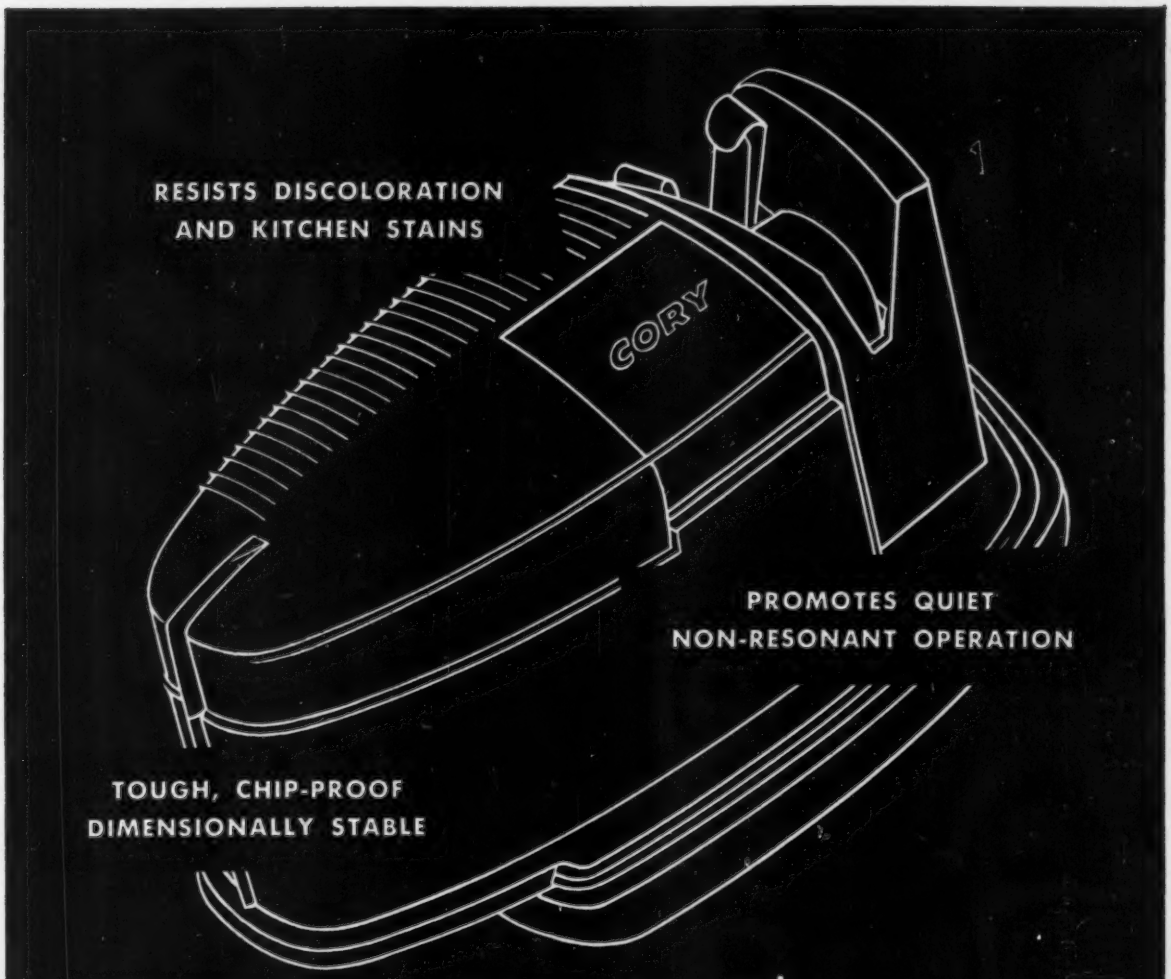
Advantages These New Models Offer!

- *Complete cleanliness without a trace of bleed-back.*
- *Easier maintenance and cleaning.*
- *Easy colour and material change.*
- *Strain-free parts.*
- *Less part distortion.*
- *Lower injection and clamping pressures.*
- *Weight savings up to 10% in a great number of cases.*

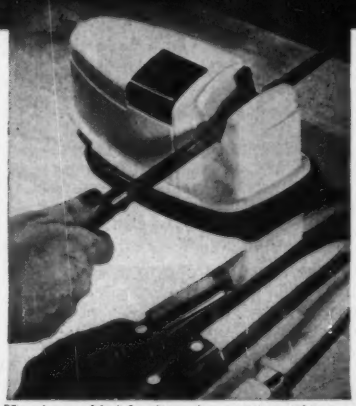
Agents for U.S.A. & Canada
F. J. STOKES MACHINE CO.
Philadelphia 20, Pennsylvania
WILMOD CO. PLASTIC DIVISION
2488 Dufferin Street, Toronto

Write today for further information . . .

R. H. WINDSOR LTD. Leatherhead Road, South Chessington, Surbiton, Surrey, England
Phone EPSOM 5631 (Private Branch Exch.) Grams & Cables 'WINPLAS' SURBITON SURREY



CORY designed to sell with HERCOCEL®



Housed in Hercocel A, the new Cory Electric Knife Sharpener has everything that makes for economical production and profitable sales. The gleaming white, attractively styled housing is quickly molded in one piece. It's tough, dimensionally stable . . . proof against casual kitchen handling. The porcelain-like finish, with color through and through, is stain-resistant . . . can't chip, peel or wear off. And Hercocel, non-resonant itself, helps assure quiet operation of the unit. For complete information on Hercocel plastics, and details of the design and technical assistance offered by Hercules, write:

HERCULES POWDER COMPANY
INCORPORATED
Cellulose Products Department, 916 Market St., Wilmington 99, Del.

Housing molded for Cory Corporation, Chicago, Ill., by G-M Laboratories, Inc., Chicago, Ill.

CP53-7

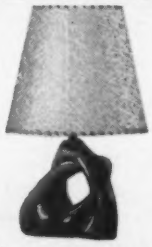
IDEAS FOR INDUSTRY

Aircraft uses are legion, include electronically transparent radomes, antenna housings, wing liners, ducts—even complete rivet-free wing sections are already in use.

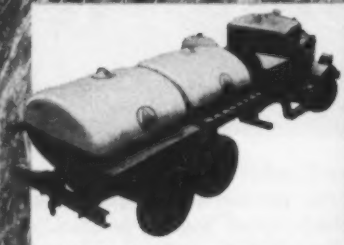
Fishing rods are livelier, stronger than finest of steels. Over 15 million in use.

Pleasure boats of all kinds—rowboats, cruisers, runabouts, outboard racers, utilities, one-design sailboats—are maintenance-free, in great demand.

Chairs like this Eames-designed prize winner can be left outdoors in all kinds of weather without marring their beautiful finish—are light in weight yet extremely durable.



Lamp shades keep their beauty longer—won't shrink, warp or sag—can be washed repeatedly with soap and water without damage. They're fire-resistant, too.



Mobile tanks transport gas, diesel fuel, water across deserts. Steel tanks formerly used needed frequent replacement because of corrosion problem.

Luggage is lightweight yet rugged—absorbs toughest knocks of traveling without showing wear or losing its original shape. Resists scuffing, staining, cracking.

Structural paneling is translucent, offers beautiful built-in colors—yet is shatterproof and sturdy enough to qualify for variety of industrial building uses.

Archery bows have unmatchable zip—never "set" even when left braced—are virtually immune to "fatigue" or breakage common to ordinary types of bows.

Sports car bodies are making auto industry headlines as Chevrolet and Kaiser-Frazer turn out finished cars. They're lighter, harder to dent, corrosion proof.

Lightweight trays and containers take heavy abuse, withstand chemicals and moisture—are used widely by industry in a variety of materials handling operations.

To make plastic products stronger, give them a backbone of glass!

In the plastics field, the folks who know best—the researchers, the designers, the molders themselves—agree that Fiberglas* reinforcements combine properties that are both unique and vital to plastics. Take strength, for example:

The filaments of glass from which Fiberglas yarns are made have amazing tensile strength—well over 200,000 psi. Moreover, this is strength without weight . . . without bulk. Strength that shrugs off rot, heat, moisture, corrosion and other forces that destroy or weaken ordinary reinforcements.

And that's why, when extra strength is a must, the plastics industry turns almost automatically to Fiberglas reinforcements . . . as they have in all of the successful product applications shown on these pages.

It's also a big reason why industry at large is turning more and more to reinforced plastics—*Fiberglas-reinforced* plastics—as a basic structural material for making good products better . . . and creating products where none existed before.

At Owens-Corning Fiberglas Corporation, the industry's most extensive research facilities and know-how are at your service. How can we serve you best?

Owens-Corning Fiberglas Corporation

Textile Products Division, 16 East 56th Street, New York 22, New York

OWENS-CORNING FIBERGLAS

Leading a great new industry forward

← *This is an actual photograph of Fiberglas reinforcing mat, one of 4 major forms in which Fiberglas reinforcements are supplied to the plastics industry. The other three are chopped strands, continuous roving and woven cloth.*

*Fiberglas is the trade mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

Need Low-Temperature Flexibility in Your Plastic and Rubber Products?

TAKE A LOOK AT THESE POUR POINTS!*

FLEXOL plasticizer 4GO (Brand)
(Polyethylene Glycol Di [2-Ethylhexoate])
-67.0°F.

. . . An excellent low-tempreature plasticizer for the vinyl chloride resins and synthetic rubbers. Rubber stocks containing 4GO have high tensile strength, high elongation, and good resilience.

FLEXOL plasticizer 3GO (Brand)
(Triethylene Glycol Di [2-Ethylhexoate])
-74.2°F.

. . . An outstanding plasticizer for neoprene. 3GO is also an effective processing aid in compounding perbunan types of synthetic rubber.

FLEXOL plasticizer TOF (Brand)
(Tri [2-Ethylhexyl] Phosphate)
-101.2°F.

. . . TOF is a recognized standard where *extra* low-temperature flexibility is required. Brittle points as low as —70°C. in vinyl compounds are common with this plasticizer. TOF combines in a single low-temperature plasticizer:

- Compatibility
- Water resistance (an excellent plasticizer for vinyl garden hose)
- Flame resistance—vinyls plasticized with TOF will not support combustion

**Temperature at which the viscosity of a plasticizer is approx. 50,000 centistokes. Low pour points are indicative of good low-temperature properties.*

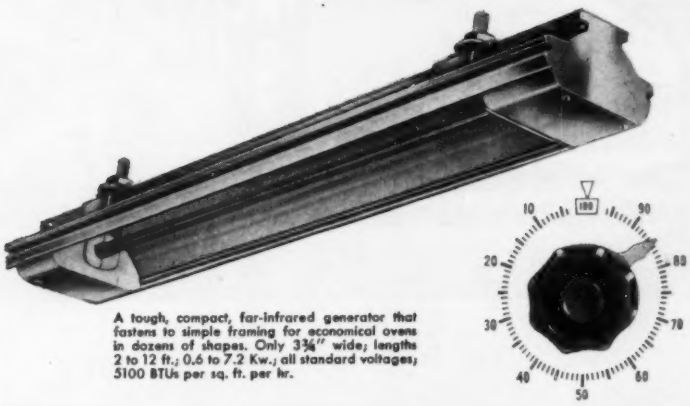
Production of vinyl plastic and rubber products for military use has made low-temperature properties more important than ever before. FLEXOL *plasticizers offer a range of low-temperature properties in combination with a wide choice of other basic properties. For more specific information on these or other* FLEXOL *plasticizers, call or write the Carbide office near you. Offices in 21 principal cities—in Canada: Carbide and Carbon Chemicals, Limited, Toronto.*

CARBIDE AND CARBON CHEMICALS

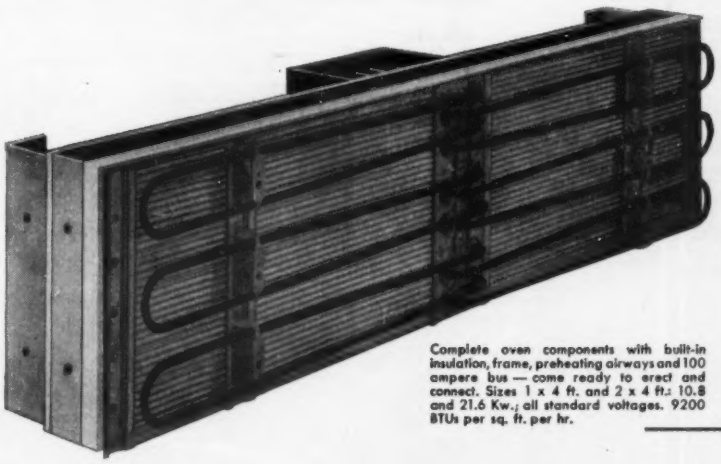
Carbide and Carbon Chemicals Company
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

"Flexol" is a registered trade-mark of Union Carbide and Carbon Corporation.

uniform heat . . .
precise heat . . .
fast heat . . .
"**color blind**" heat . . .



A tough, compact, far-infrared generator that fastens to simple framing for economical ovens in dozens of shapes. Only 3¾" wide; lengths 2 to 12 ft.; 0.6 to 7.2 Kw.; all standard voltages; 5100 BTUs per sq. ft. per hr.



Complete oven components with built-in insulation, frame, preheating airways and 100 ampere bus — come ready to erect and connect. Sizes 1 x 4 ft. and 2 x 4 ft.; 10.8 and 21.6 Kw.; all standard voltages. 9200 BTUs per sq. ft. per hr.

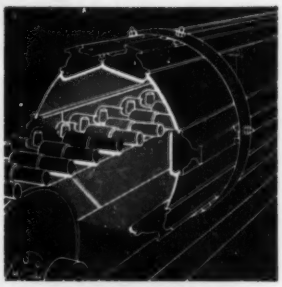
A Chromalox Electric Radiant Panel or Chromalox Radiant Heater installation gives you a quick, low-cost answer to your baking, curing, drying and other heating needs. Pre-engineered units allow on-the-spot erection and connection. You get up to 700° F. work temperatures; absolutely uniform radiation with no hot and cold spots; high intensity heat that's absorbed *f-a-s-t* by all colors; and accurate "dialed" heat from 0 to 100% of capacity.

CHROMALOX *Electric*

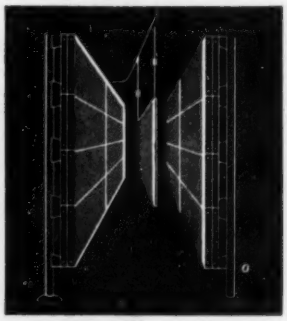
Far-infrared Units

TWO JOB-PROVED FAR-INFRARED TYPES TO CHOOSE FROM!

You'll find Chromalox pre-built Radiant Panels and Heaters from stock fit your jobs and your budget. Shown below are just two of the literally hundreds of oven shapes and sizes which can be erected quickly and easily using Chromalox Electric Radiant Units.



Conveyorized oven built on the job using Chromalox Radiant Heaters. Units are installed in lengths and ratings needed to fit the work. Input controller gives precise and exact temperatures easily adjusted to meet varied processing requirements. Easy to assemble, easy to wire.



Chromalox pre-engineered Radiant Panels are easily and quickly erected and connected to form ovens and drying tunnels of any size and shape. An oven such as sketched may be installed in 20 to 30 man-hours with minimum engineering expense and lowest cost per installed kilowatt.

Have a Problem Involving Degreasing, Drying, Baking, Preheating, Curing?

The assistance of Chromalox Application Engineers is yours for the asking. They'll help you work out your specific requirements without obligation. Write today.

EDWIN L. WIEGAND CO. IC-70
7503 Thomas Blvd., Pittsburgh 8, Pa.

I'm interested in electric heat for.....
.....
.....

☐ Send me Bulletins on Far-infrared units.
☐ Have a Chromalox Application Engineer get in touch with me.

Name.....
Company.....
Street.....
City.....Zone.....
State.....

FORD ROTUNDA

Every visitor within travel reach of Detroit should, this year, take advantage of the Ford invitation to spend some time at the fabulous Rotunda. This commemoration of 50 years of automotive progress fascinates everyone with its animated displays and exhibits.

Along with machines in miniature is one in full-size—and in actual operation. Ford chose a Fellows Injection Molding Machine to mold souvenir medallions before the visitor's eyes.

The Fellows 1B-3-15 is set up for full-automatic operation. Moreover, the gravity discharge is arranged automatically to separate the pin-point gated medallions from the runner system.

Fellows has pioneered in molding machine advances with—full-automatic operation—
one operator to several machines—faster cycling
to production speeds never before attained.

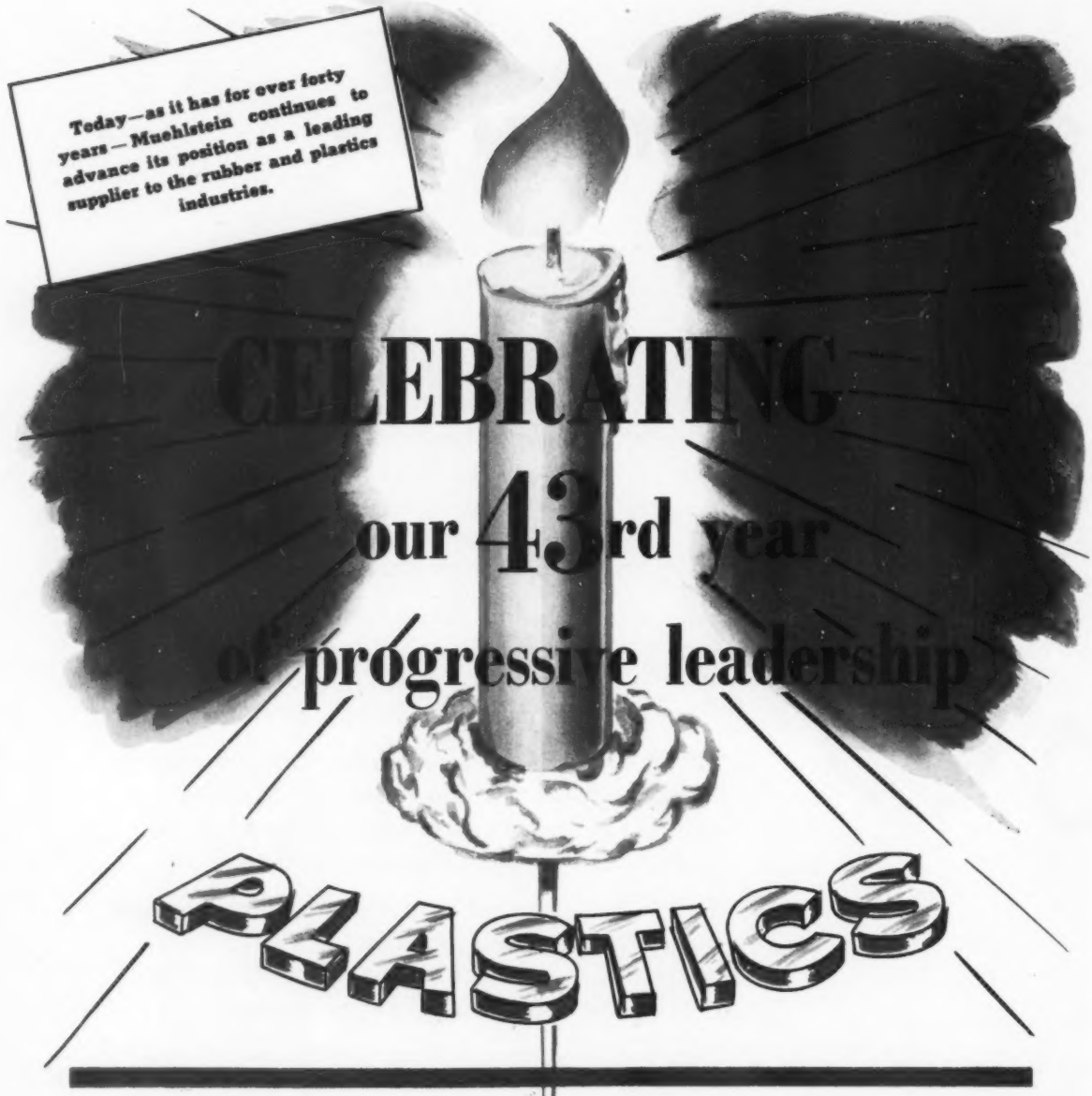
Why not investigate Fellows money-saving speed and work-saving automatic features. Your nearest Fellows Representative has all the facts.

"This machine is typical of the modern manufacturing equipment created through the use of new materials in processing automotive parts."

Exhibition inscription over Fellows Model 1B-3-15 Injection Molding machine at the Ford Rotunda.

molding equipment

The Fellows Gear Shaper Company, Plastics Machine Division. Head Office and Export Department, Springfield, Vt. Branch Offices: 323 Fisher Building, Detroit 2, Mich.; 5835 West North Ave., Chicago 39, Ill.; 2206 Empire State Building, New York 1, N. Y.



REPROCESSED PLASTICS

If you sell plastic scrap . . . buy reprocessed plastics or have scrap reprocessed—Muehlstein offers you complete service. Our laboratory facilities and technical staff assure satisfaction—especially with color problems.

FOSTARENE

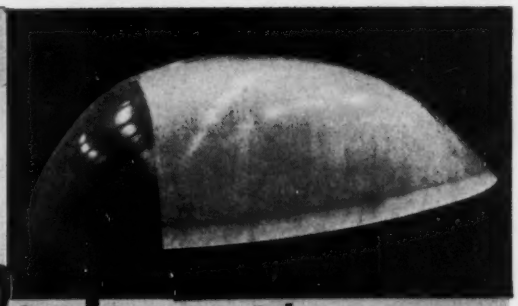
Muehlstein, as exclusive distributors of Fostarene, offers you a dependable source for quality Virgin Polystyrene. Our technical and sales organization assure you of prompt, reliable service.

H. MUEHLSTEIN & CO. INC.

60 EAST 42nd STREET, NEW YORK 17, N. Y.

BRANCH OFFICES: Akron · Chicago · Boston · Los Angeles · Memphis
WAREHOUSES: Akron · Chicago · Boston · Los Angeles · Jersey City

From Giant Radomes That Protect Electronic Equipment—To Helmets For Construction Workers!



Pittsburgh Selectron Polyester Reinforcing Resins

Now Ready For a Thousand New Uses

PITTSBURGH SELECTRON Resins have opened numerous opportunities for vastly broadened product usefulness with greatly reduced manufacturing costs in many cases.

● **When combined** with suitable fillers—Fiber Glass, cotton, rayon, nylon, felt, sisal, paper, etc.,—SELECTRON Resins have been used to mold products that are lighter than aluminum with strength-weight ratios and impact resistance surpassing those of any other known materials. They also provide unusual resistance to weather, sunlight, heat, abrasion and many chemicals.

● **Because of such unique** and distinctive advantages, SELECTRON Resins are today being used in a wide range of products. These are as different in size and shape as helmets for construction workers, manufactured by the Automatic Plastic Molding Company, of Berkeley, Calif., for the E. D. Bullard Company, of San Francisco, and giant radomes that protect electronic equipment in aircraft, produced by several large makers.

● **SELECTRON Resins** are of the thermo-setting type. They polymerize to form solids with or without heat and with or without pressure. Parts in which they are used can be molded either by hand lay-up, direct molding, continuous lamination or pre-forming. These resins can also be used without fillers for casting, potting and impregnating.

● **Because of their** unusual utility, more and more manufacturers are probing the seemingly endless possibilities of SELECTRON Resins. If you are designing a new product, or redesigning one you are now making, SELECTRON may help you make it lighter, stronger, more durable and, possibly, at lower cost. Call on us for *free* advisory service. We may be able to save you time and money.

Send For FREE Booklet!

● Write, wire or phone today for our new booklet containing description of SELECTRON Resins and explaining many of the ways in which they can be used. Pittsburgh Plate Glass Company, Selectron Products Division, 2000 Grant Building, Pittsburgh 19, Pa.

Just a few products in which Pittsburgh SELECTRON Resins are now used—

Aircraft structural parts
Radomes for electronic equipment
Life floats
Ballistic panels
Helmets
Boat hulls
Machinery housing and guards
Trays
Tote boxes
Food lockers
Garbage pails
Baskets for automatic dishwashers
Baskets for automatic washers
Wash tubs
Tool chests
Shipping containers
Instrument cases
Laundry hampers
Kitchen containers
Fishing rods
Helmets
Sinks
Street signs
Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
Gas meter housings
Structural panels for offices and homes
Door and transom lights
Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

PITTSBURGH Selectron

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

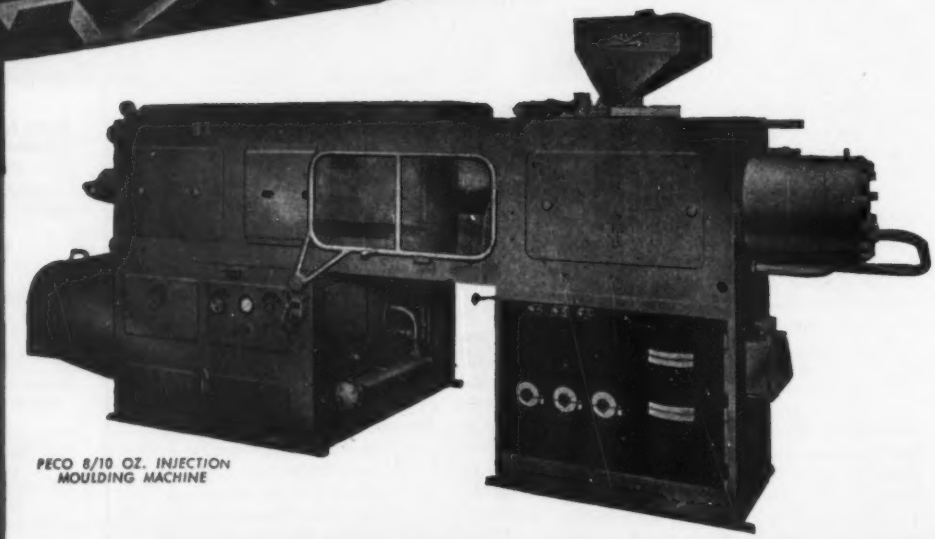
facts that speak for themselves

12,000
SHOTS *per* WEEK

8-impression moulding in polythene, of automobile number plate digits and letters. Mould designed and mouldings produced by the Mentmore Manufacturing Co. Ltd. in conjunction with Hills (Patents) Ltd. under Patents Nos. 661276 and 661354.

The record of weekly production can be taken as typical of the first-class performance of PECO MOULDING MACHINES. Their output can be relied on—and it is a maximum output for any type of production.

In the 8 oz. and 16 oz. machines, important new developments have been introduced, giving increased shot capacity and enabling these models to be uprated to, respectively, 8/10 oz. and 16/24 oz. machines. Further details of the full range, including smaller capacity machines, will be gladly sent on request.



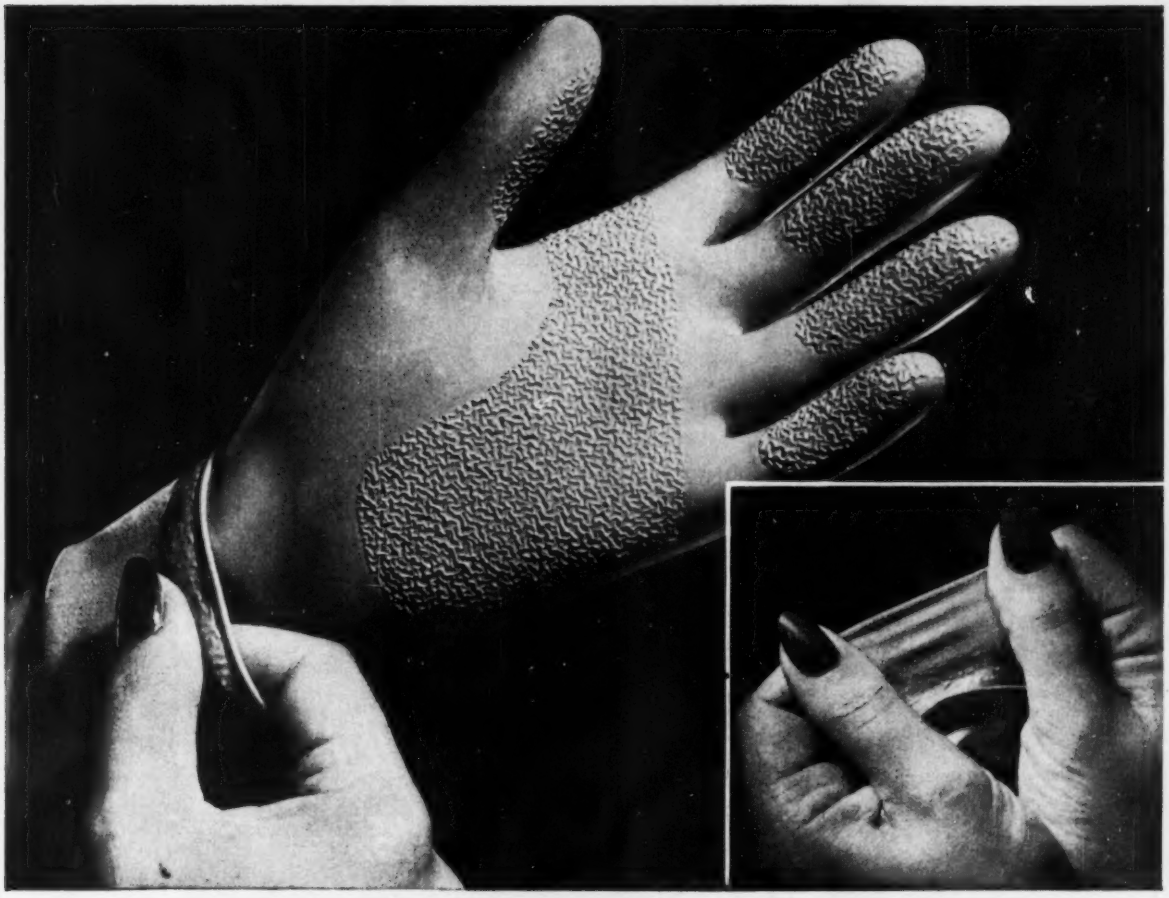
PECO 8/10 OZ. INJECTION MOULDING MACHINE

PECO PRODUCTS

THE PROJECTILE & ENGINEERING COMPANY LTD.

WEST STREET, FAVERSHAM, KENT, ENGLAND

Another new development using AMERICAN ANODE *materials*



WE GAVE THEM A NEW INNER SKIN—for more comfort, longer life

MANY types of household rubber gloves are hard to put on and take off, or become uncomfortable and clammy from perspiration. Problems that housewives and others have long hoped would be solved.

Well, here's a glove that takes care of those problems and more!

It has a smooth, flock lining that feels like fine suede. Gloves slip on and off easily. The flock absorbs perspiration—dries quickly if wet. And what makes the flock lining work so well is a special adhesive developed by American Anode.

The adhesive holds the flock tightly to the inner surface of the glove. Moisture, body acids, etc. can't affect the adhesive and cause loosening of the flock. The adhesive won't harden with age; it remains permanently flexible, gives the gloves added life.

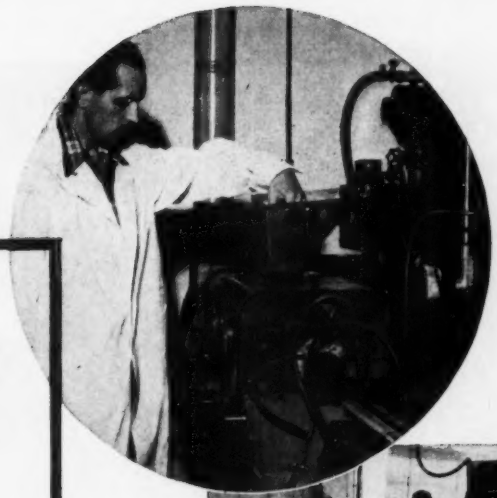
Developing a material to help improve these household gloves is typical of the many jobs American Anode does—jobs that solve product problems and help sales appeal.

Perhaps we can help you—wherever latices or plastisols are involved. Let's talk it over. Write Dept. AD-6, American Anode, 60 Cherry Street, Akron, Ohio.

AMERICAN ANODE

The B. F. Goodrich Company
Industrial Products Division

CRUDE AND AMERICAN RUBBER LATICES, WATER CEMENTS AND SUSPENSIONS, AMERAN RESIN PASTES, COMPLETE MANUFACTURING FACILITIES

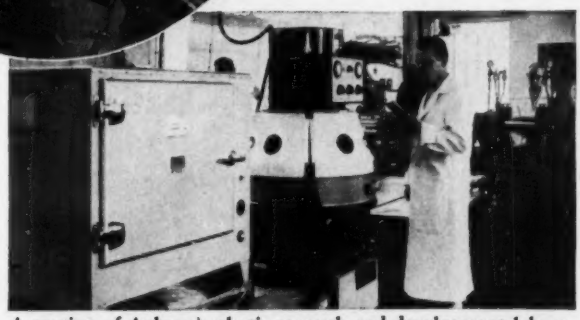


"The dependability and precision work of our NRM equipment," Mr. Woodruff said, "led to the selection of this NRM Extruder to handle *critical* testing and pilot operations in our Extruding Department Laboratory."

Why
AUBURN BUTTON WORKS
INCORPORATED

PREFERS

NRM *Extruders*



A portion of Auburn's plastic research and development laboratory . . . Auburn's complete laboratory facilities assure customers that all technical problems are worked out in advance of plastics production.

"In our long history as a processor of plastics," stated Mr. Douglas Woodruff, Jr., Vice President of Auburn Button Works, Inc., Auburn, N. Y., "we've had ample opportunity to compare various extruder makes, and today we operate more NRM Extruders than any other kind. The NRM's are operated 24-hours a day, every day in the week, and often under peak loads. Their ability to stand up under these conditions, producing top quality extrusions from the many different plastics we use — without excessive maintenance — is conclusive proof of NRM's design and operational advantages. Auburn Button Works, Inc., is the oldest plastics processing firm in America. Starting as a small button factory 75 years ago, Auburn's manufacturing space now totals 159,000 sq. ft., and its complete facilities are devoted entirely to manufacturing parts for industry.

Like Auburn, other plastics manufacturers, here, and all over the world, *prefer* NRM Extruders for the "design and operational advantages" that enable them to produce top quality extrusions, economically, from all thermoplastic extrusion compounds. If *you* are planning to purchase plastic extruding equipment, let us send you the details of the NRM line today. See for yourself how such advanced features as NRM's balanced heat control, quick opening die gate, patented screw design and "Cyliner" construction, can work to *your* advantage in extruding all thermoplastics. A postcard brings you full information, promptly, at no obligation.

NATIONAL RUBBER MACHINERY COMPANY

NRM — Our 25th ANNIVERSARY 1928-1953 — *Creative Engineering*

General Offices & Engineering Laboratories: Akron 8, Ohio
East: 384 Getty Ave., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Cal.
Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.

E187

"Mister Boonton, mold these please,
And make them better, too.
Metals could not do the job,
That's why I've come to you."

"Nice of you to think of us,"
Is what we did reply.
"Tell us how much time we've got,
Before deliver-eye."

"Take all the time you want with it,"
The voice came loud and clear.
"I really won't be needing them
Before about a year."

"Mister Boonton, you can choose
Of what they should be made.
I'll tell you just what they must do,
And *you* can pick the grade."

"Quote me please, a price that's fair,
That's all I ask of you.
I'll pay a price that's fair and square,
And swear not to argyue."

"Chaps like this are rare indeed,"
Kept running through our head.
We knew it really *was* a dream,
When we awoke . . . in bed.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE—CHANIN BUILDING, 122 EAST 42ND STREET, OXFORD 7-0155

5,850 sizes...and they all give all these advantages

MAYBE the tapered roller bearing you need is small enough to hold in your hand. Or maybe it's a whopper like the one in the upper left corner of the picture. Whichever it is—or any size in between—we can supply it. The Timken Company makes 5,850 sizes and 26 types of tapered roller bearings—one of which could be the answer to your bearing problem.

A wide selection of types and sizes is only one result of our more than 50 years of helping manufacturers with special bearing problems. Over those years, we've constantly improved our designs and quality. Today *any* Timken® tapered roller bearing you buy gives you all these advantages:

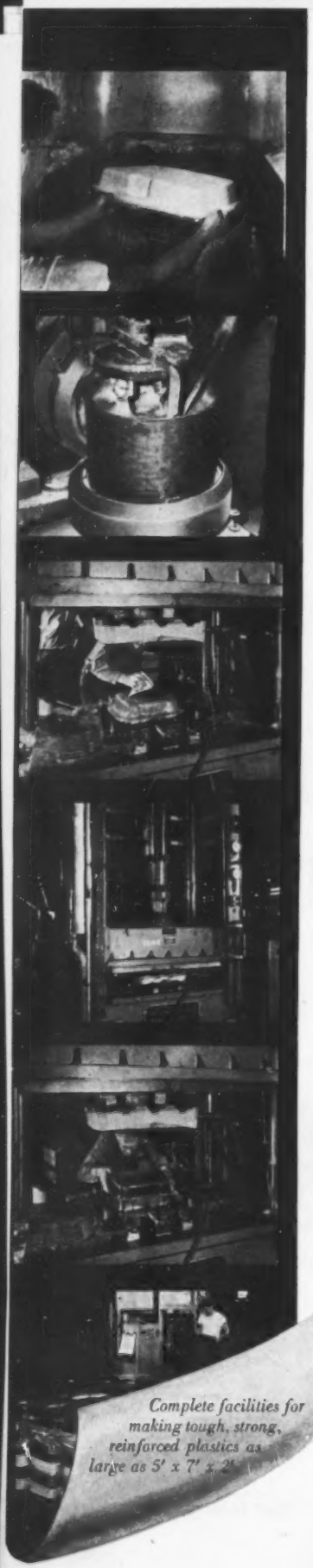
1. Tapered construction permits carrying radial and thrust loads in any combination.
2. True rolling motion and micro-inch surface finish to minimize friction.
3. Precision manufacture which makes possible bearings with maximum runout tolerance of less than 75 millionths of an inch.
4. Positive roller alignment which gives maximum bearing capacity.
5. Made of Timken fine alloy steel, specially developed for long bearing life.
6. Case-hardened bearing surfaces that resist wear.
7. Tough core to resist shock.

If you're buying machinery, look for the trade-mark "Timken" on the bearings. If you're building machinery, specify Timken bearings. Or if you're replacing worn bearings, insist on Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN TAPERED ROLLER BEARINGS

TRADE-MARK REG. U. S. PAT. OFF.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⓪ AND THRUST →⓪← LOADS OR ANY COMBINATION →✳←

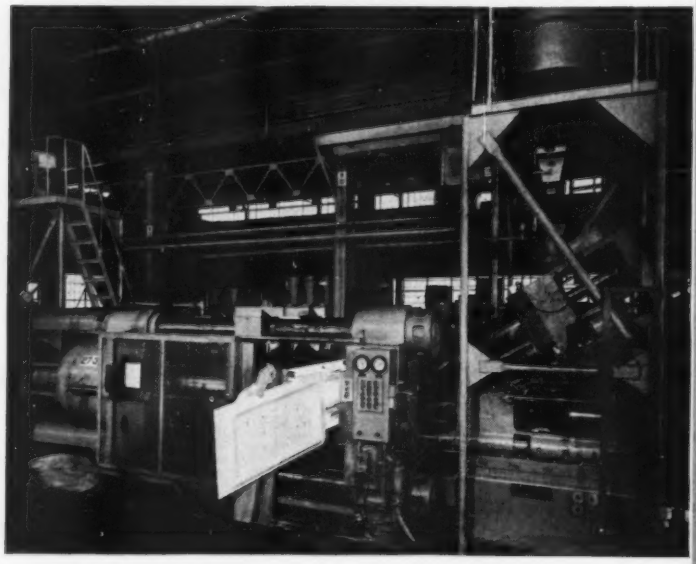


Complete facilities for making tough, strong, reinforced plastics as large as 5' x 7' x 2'

Good ideas molded in plastics by

This 2,000 ton compression press molds a complete console television cabinet every few minutes.

Batteries of huge 300-oz. injection presses produce—in one shot—a complete inner door panel for a 12 cu. ft. refrigerator.



General American

You may be able to do more with plastics than you thought you could! At General American, we're working with manufacturers who never before had considered plastics. Old limitations of size, shape and color are being removed. New design possibilities and styling are adding saleability to products and parts of all kinds.

By taking full advantage of equipment that is unmatched anywhere for large-scale injection, compression and reinforced plastics molding, we've been able to improve old products, mold many new products—as well as cut production costs for customers.

We'd like to help you see your ideas take form in plastics *correctly applied.*

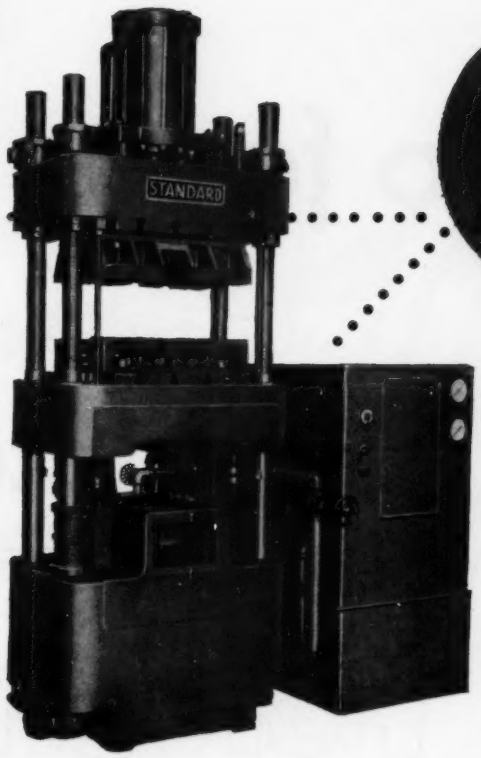
See General American for plastics molding

PLASTICS DIVISION
General American Transportation Corporation
135 South La Salle Street • Chicago 90, Illinois
Phone: Financial 6-4100

PLASTICS DIVISION GENERAL AMERICAN TRADE MARK

STANDARD MOLDING PRESSES

assure.....



TOP

performance

LOW

cost

STANDARD MOLDING PRESSES, both compression and transfer models, produce top-quality molded products because their perfected toggle construction, with finely synchronized operations, controlled speeds, fast opening and closing action, and automatic change-over from low to high pressure make for IDEAL MOLDING ACTION—ACCELERATED OPERATION—INCREASED OUTPUT.

STANDARD MOLDING PRESSES perform at *low cost* because: (1) Installation is inexpensive—the units are completely independent of auxiliary equipment, can be assembled in half a day. (2) Cost of maintenance is lower—relatively low hydraulic pressure is needed. (3) There is little or no time out for servicing—extra-sturdy presses are specially designed to operate continuously over long periods.

Small wonder STANDARD MOLDING PRESSES have been the choice of leading manufacturers around the world during the past 17 years!

DS

DAVIS-STANDARD SALES CORPORATION

16 Water Street, Mystic, Connecticut

Sole Selling Agents for

THE STANDARD MACHINERY COMPANY

Extruding Machines and Molding Presses

To focus on the

Look into

BAKELITE
TRADE-MARK

Polyethylene

YOU'LL MAKE TOMORROW'S NEW PRODUCTS COME CLOSER

THE THINGS this plastic can do . . . the many ways it can be used...will stir the imagination of designers and manufacturers like no other plastic before.

Products lingering on drawing boards, or in idea-pending files for want of the *right* material, may now be projected into wonderful new products that can dominate tomorrow's markets.

There's hardly an industry, or a product that cannot benefit in some new, exciting way from the remarkable combination of properties of this dynamic new plastic . . . whose uses and demand are growing by leaps and bounds.

Focus your sights on the future now. Let the power of BAKELITE *Polyethylene* expand your ways and means to make more, newer and better products. Though it has been in short supply, new plants are now under construction to expand production.

Time your own development work so you will be ready to benefit in the future.

Get the Right
FILM SLITTER

First, consider your roll production requirements. Then consult with Cameron engineers. Investigate modifications designed to meet your exact slitting and roll winding needs. You'll wind up with a machine custom-fitted to your job — a CAMACHINE!

BELOW: A few of the modifications available on the popular CAMACHINE Type 26 slitter-rewinder.

26-R-7 — razor blade slitting at speeds up to 700 fpm.

26-7 — score-cut slitting with built-in automatic web tension.

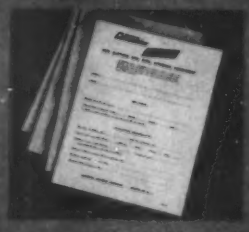
26-S1 — Sealcut* — heat seals edges of strips instantly as it cuts.

26-3(RM) — both score-cut slitting elements and razor blade slitting attachment.

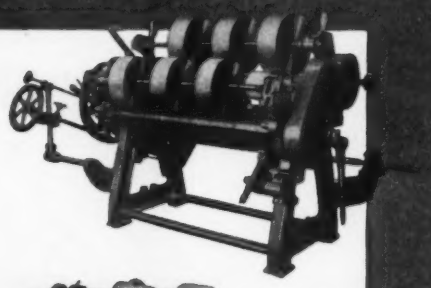
CAMACHINE DATAFORM

Use this simplified form to get a prompt recommendation on the right equipment for your roll production job. Write today for your copy of the Dataform.

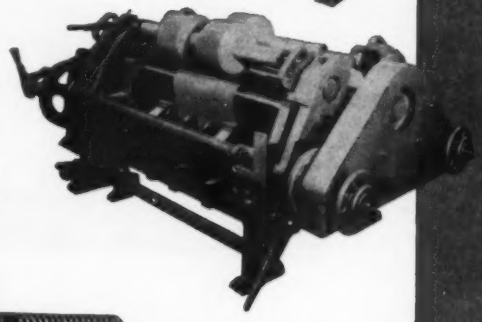
*registered trade name

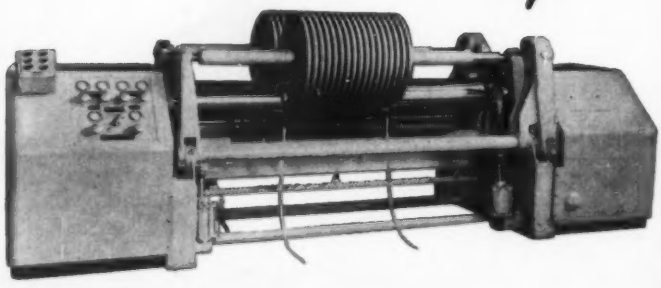


TYPE 26 — For light to heavy gauge plastic films. Rated at speeds up to 500 fpm. Score-cut slitting; combination surface and center rewinding; positive roll separation.



TYPE 28 — For light to heavy gauge plastic films. Rated at speeds up to 800 fpm. Choice of score-cut or shear-cut slitting; combination surface and center rewinding; positive roll separation.

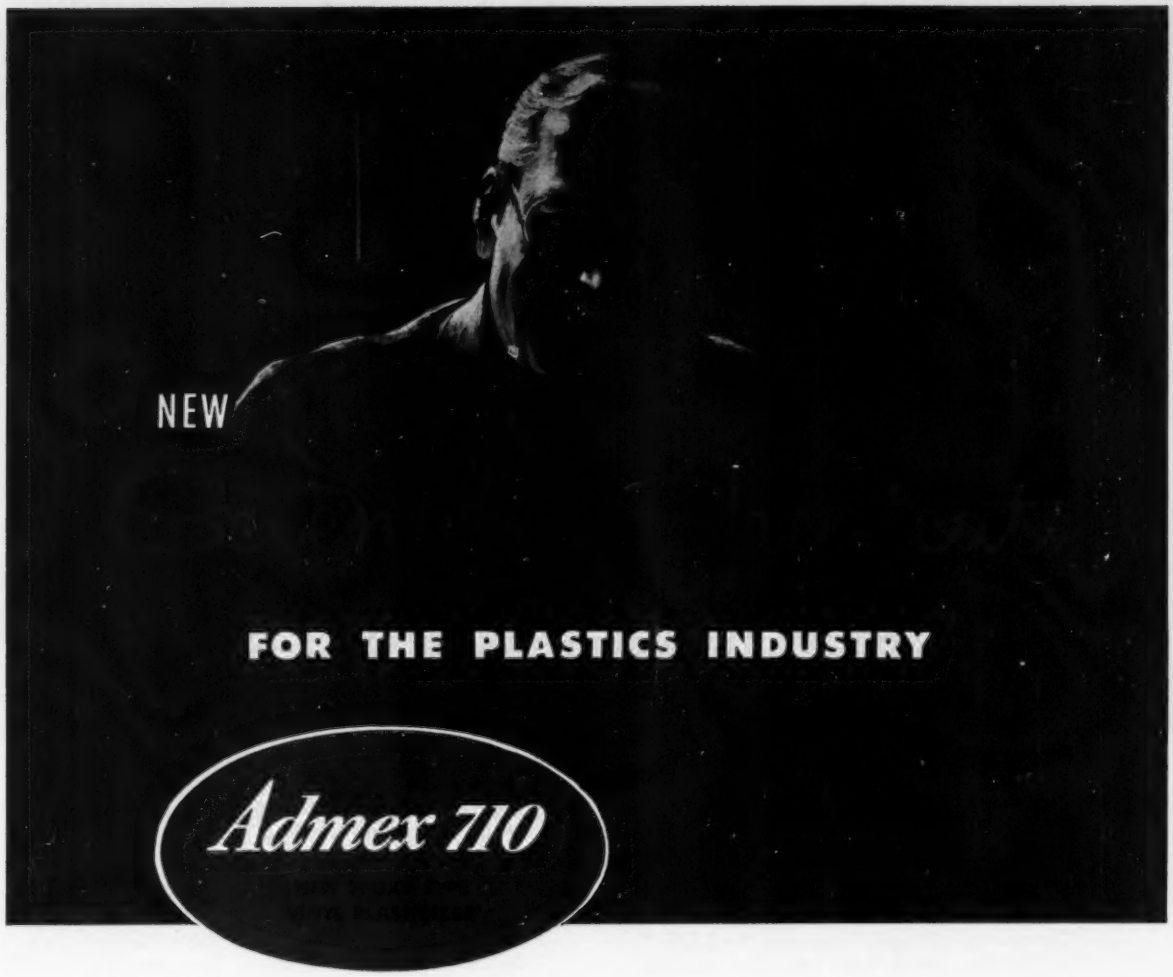




TYPE 29 — A heavy-duty machine rated at speeds up to 1500 fpm. 36" diameter rewind capacity. Score-cut slitting; combination surface and center rewinding; positive roll separation.

CAMERON MACHINE COMPANY — 61 POPLAR STREET — BROOKLYN

Don't wind up with less than a Camachine



Here's an entirely new idea for the plastics industry . . .

a *Scientific Shortcut* which will reduce your production costs, trim your plasticizer inventory, and lower your shipping costs.

This money-saving idea is based on *Admex 710*, ADM's new multi-purpose, epoxy type vinyl plasticizer which will replace several specialized plasticizers, yet improve the quality of your products. *Admex 710* offers a unique combination of the ten basic qualities sought by vinyl processors.

No other plasticizer on the market imparts such a high degree of performance in these ten essential qualities.

Check your inventory. Note how many plasticizers you are using. *Admex 710* can reduce this number, reduce your inventory investment, simplify your purchasing, trim production costs, enable you to buy in larger quantities and save on freight.

A complete 21-page technical bulletin is ready for you and samples are available for evaluation. Fill out and mail the coupon today so we can help you cut your plasticizer costs.

Take the **ADM**

SCIENTIFIC SHORTCUT

with ***Admex 710***

Other ADM Products:
Linseed Oil, Soybean Oil, Fish Oil, Paint Vehicles, Fatty Acids, Fatty Alcohols, Hydrogenated Glycerides, Sperm Oil, Foundry Binders, Industrial Cereals, Vegetable Proteins, Wheat Flour, Dehydrated Alfalfa Meal, Chlorophyll, Livestock and Poultry Feeds

ARCHER-DANIELS-MIDLAND CO.
600 Roanoke Building, Minneapolis 2, Minnesota

☐ Please send me *Admex 710* Technical Bulletin
☐ Please send me *Admex 710* Evaluation Sample

Name _____

Firm _____

Street _____

City _____ *Zone* ____ *State* _____

MP

TODAY'S OUTSTANDING MOLDING MACHINES . . .

THE LEWIS "4"

This small size injection molding machine can mold large projected area parts originally produced on 8-ounce equipment. Compact and simple to operate, the LEWIS "4" is the lowest cost molding machine available today for high speed production of 2 to 3 ounce parts. Plasticizing capacity is 30 pounds of material per hour.

Features of the LEWIS "4" include multiple shot injection . . . semi-automatic operation . . . ability to work with almost any molding material. Clean, simplified construction assures maximum production with minimum maintenance . . . fast opening crank-operated die-lock mechanism clears jammed nozzles in 20 seconds or less.

The LEWIS "4" requires only 16 square feet of floor space. This machine will handle molds up to 12"x23" mounted vertically and 13⅜"x20" mounted horizontally.

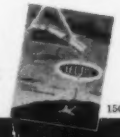
Write for Bulletin 101 describing the Model "4".

THE LEWIS "6"

Designed for production molding a wide range of parts having large projected areas, the LEWIS "6" does the work of considerably larger units at a fraction of their initial and normal operating costs. This machine will plasticize up to 60 pounds per hour and shots greater than 7 ounces of polystyrene can be molded at the rate of 2½ per minute. The LEWIS "6" features the exclusive new "HYDRA-LOCK", the safest and most powerful hydraulic clamping device available today. Requiring only a cupful of oil, the "HYDRA-LOCK" develops a 200-ton clamping pressure in tenths of a second. In addition, the "HYDRA-LOCK" clamp's design facilitates quicker, easier mold setting procedures.

All features of the LEWIS "6" are included in one remarkably low price. These include injection pressures up to 15,000 psi, large area platens, compensating feed, finger tip controls, fast opening die-lock mechanism, automatic molding cycle and minimum maintenance.

Write for Bulletin 102 describing the Model "6".

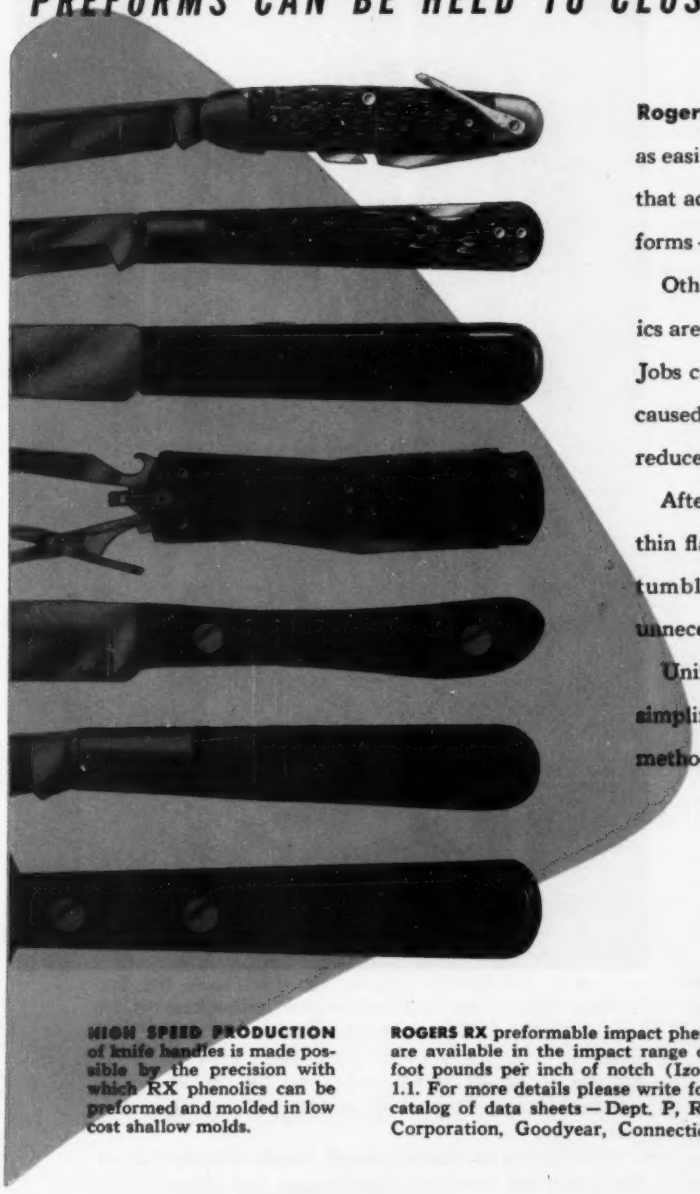


1506-LW

THE LEWIS WELDING & ENGINEERING CORP.
11 INTERSTATE STREET BEDFORD, OHIO

Why ROGERS CORPORATION Impact Phenolics SPEED MOLDING OPERATIONS

PREFORMS CAN BE HELD TO CLOSE WEIGHT TOLERANCES



Rogers RX impact phenolics can be handled almost as easily as general purpose materials. One reason is that accurate weight tolerances can be held on preforms – as close as 1% if desired.

Other reasons are that Rogers RX impact phenolics are fast curing and low in bulk factor (3.5 to 1). Jobs can be run on high speed presses. And rejects caused by overloading or underloading are sharply reduced if not eliminated.

After molding, parts of Rogers phenolics have a thin flash, which can be easily removed – often by tumbling. Costly hand finishing operations are unnecessary.

Uniform pellet size of Rogers impact phenolics simplifies and speeds volumetric loading when this method is required.

HIGH SPEED PRODUCTION of knife handles is made possible by the precision with which RX phenolics can be preformed and molded in low cost shallow molds.

ROGERS RX preformable impact phenolics are available in the impact range of .05 foot pounds per inch of notch (Izod) to 1.1. For more details please write for our catalog of data sheets – Dept. P, Rogers Corporation, Goodyear, Connecticut.

Better Parts for Better Products

ROGERS CORPORATION

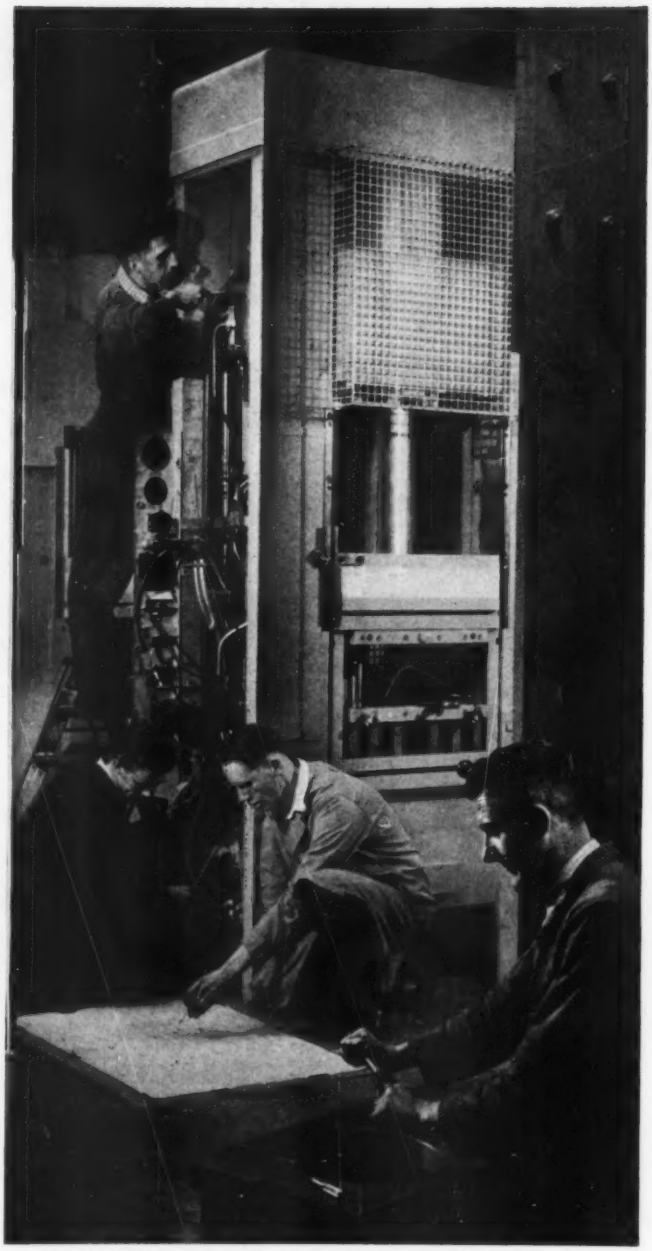
Established in 1832

YOU NAME IT — WE'LL MAKE IT — AND FABRICATE IT, TOO

DUROIDS	ELECTRICAL INSULATION	PLASTICS	SHOE MATERIALS
for Gaskets, Filters, Electronics . . .	for Motors, Transformers, Generators . . .	Molding Compounds and Laminates	for Counters, Midsoles, Liners

YOU SAVE WHEN ROGERS FABRICATES FINISHED PARTS

This press sets new standards for efficiency and economy



THE PRESS the men are building is a Bipel downstroking prefiller press. This particular type of press has made a mark for fine compression and transfer molding wherever it has been installed.

What you cannot see in the picture, of course, is the *great* difference between this compact Bipel and a conventional four-column press. Here is a *complete* molding machine, compactly built, better designed and engineered in every detail, and much more flexible in use. Additionally, at just the push of a button, the Bipel's patented "auto control" will, once set, faithfully reproduce any molding cycle regardless of its complexity.

Perhaps an example or two of the Bipel's superiority would be in order. One user, on a 7" molding reports a tolerance of ±.003" with a Bipel, as contrasted with ±.014" on column type presses. Another user reports that his sixty ton Bipel will close, apply sixty tons clamping pressure, and start to transfer the material all within two-and-a-half seconds.

The performance of the Bipel press is closely dependent upon the advantages of the Bipel line feed system with a single central power unit. One such power unit, using trouble-free medium pressure which is stepped up to higher pressure *at the press*, can drive as many as twelve Bipel presses. A miniature of this unit can be built into the press frame for single press installations. The components, the pumps and the accumulators, are remarkably inexpensive to install and to maintain.

This unique line feed system plus in-the-press intensification provides a range of three working pressures (1:1, 2:1, 3:1) per press. Bipel Type 40 operates at 20, 40 or 60 tons; Type 100, at 50, 100 or 150 tons; Type 200, at 100, 200 or 300 tons.

We are certain that additional details will further prove the worth of Bipel presses and power drives. Your request will be answered promptly.

B·I·P GROUP

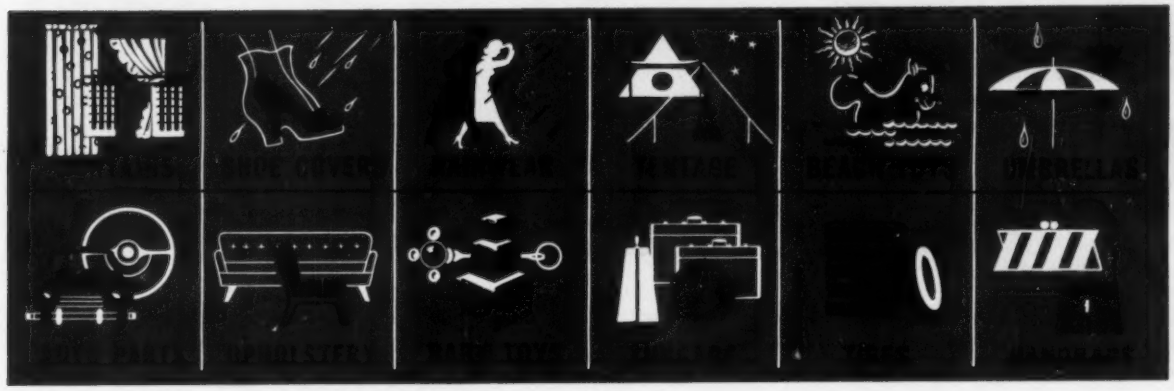
B.I.P. ENGINEERING LTD.

Aldridge Road, Streetly, Staffs, England

Drew produces a choice of Plasticizers for use in manufacturing a wide range of products requiring toughness, permanence and flexibility under extreme heat and cold. Outstanding among these Drew quality products is PLASTICIZER SC.

SC Offers extreme flexibility under extreme heat or cold, and assures reliability and permanence in the finished product. SC promotes wetting and dispersion of filler in production. Exceptionally stable and resistant to oxidation and rancidity, it is widely used in Vinyl Resins for high plasticizing action down to temperatures as low as —70°F.

Recommended for a wide variety of applications, including embossed surfaces, fabric coatings such as raincoats, tenting, car covers; shoe soles, wire and cable insulation, medical tubing, etc. SC is easily emulsified, and can be conveniently added to aqueous dispersion of synthetic resins and rubbers.



OTHER DREW PLASTICIZERS OFFER OUTSTANDING PROPERTIES

DP 200

An excellent all-purpose plasticizer with exceptionally low heat loss and low "sweat-out". Provides plastic action down to –50°F. DP 200 gives low brittle points to vinyl chloride plastics. Low viscosity—ideal as softener for synthetic rubber manufacturing.

DP 250

A light colored, low viscosity polymeric type plasticizer which retains the easy handling properties of lower weight monomeric types. Affords good low temperature flexibility, excellent resistance to heat and light aging. Very resistant to leaching action of oils. Produces good results as an aid in pigment wetting and grinding, extrusion and calendering.

DP 520

The protein plasticizer. Gives products flexibility, clearness, toughness, permanence and exceptional stability against humidity. Low susceptibility to heat or cold. Compatible with natural or synthetic resins. The plasticizer for casein, zein, soybean protein and synthetic rubber compounds. Ideal for making coatings, adhesives, impregnants, inks and other protein base products.

For complete details and technical data on all Drew Plasticizers, call or write

DREW PRODUCTS

TECHNICAL PRODUCTS DIVISION

E. F. DREW & CO., Inc.

15 EAST 26th STREET, NEW YORK 10, N.Y.

BOSTON • PHILADELPHIA • CHICAGO

The 20 ounce Lester is, without any question, the most economical machine built for molding tile. Here are the facts to substantiate this claim:

At Detroit Plastic Tile Co., they're molding 1600 pieces per hour (and we're talking about the standard .065 thick, 4-1/4 x 4-1/4 deluxe wall tile). The best 8 oz. machine we've ever seen will mold about 900 pieces per hour of this tile. Assuming labor costs to be equal, but including an increased cost for power consumption with the larger machine, this 1600 to 900 ratio represents a reduction in cost per tile of over $6.00 per day.

However, here are the really startling figures: That extra 700 tiles is 87 sq. ft. Using the average molder's selling price and multiplying these figures by a 24 hour day, you've got $417.60. Allowing only a modest 8% profit, you've got $33.41 per day, plus the $6.00 saving in production. Figure a 300 day working year and you've got a resounding $11,823!

Now, the 20 ounce Lester costs up to $10,000 more than an 8 oz. machine. You can see that you would have the cost differential returned in little more than 10 months and then the machine would be earning an *extra* $1000 per month!

And this doesn't take into account the equally important saving effected through holding wall thicknesses to size, practical elimination of rejects, and reduction of down-time.

To quote Mr. Alonzo Tripp, president of Detroit Plastic Tile: "We're tickled pink with the way the Lester has been working for us. We never realized that our tile costs could be so low."

LESTER INJECTION MOLDING MACHINES

REPRESENTATIVES

New York . . . . Steven F. Kreuld
Detroit . . . . . Thoreson-McCosh
Chicago . . . . . J. J. Schmidt
Cleveland . . . . . Don Williams
Coral Gables . Morton Machinery Sales
Seattle . Perine Machinery & Supply Co., Inc.
Cincinnati . . . Index Machinery Corp.
Los Angeles . . . Seaboard Machinery Co.
San Francisco . . . . . J. Fraser Rae
St. Louis, Milwaukee . . . . A. B. Geers
Providence . . . . Sydney W. Lohman

FOREIGN

Toronto, Canada . . Modern Tool Works, Ltd.
Sydney, Australia . . . Scott & Holladay, Ltd.
Japan . . . . Okura & Co., New York, Inc.

distributed by LESTER-PHOENIX, INC., 2621 P CHURCH AVENUE • CLEVELAND 13, OHIO

I.C.I. PLASTICS

Serve the Shopfitter

A revealing example of the way in which plastics play their part in modern shopfitting is this new Sainsbury* self-service store at Eastbourne. Versatile, shatter-proof 'Perspex' sheet—clear and coloured—is put to good use in the counter display shields, the windows and surrounds of the refrigerated cabinets, and the egg and tea containers. The diffusing covers of the fluorescent lighting units are in opal 'Perspex', while corrugated 'Perspex' has been cleverly used for the egg display racks.

Other I.C.I. plastics at the shopfitter's service include 'Darvic' rigid p.v.c. for display signs and fittings, and 'Mouldrite' phenol and urea formaldehyde moulding powders for robust, colourful moulded products, while there are numberless other display uses for 'Perspex' itself.

* Equipment shown includes material patented, and designs registered, by Messrs. J. Sainsburys.

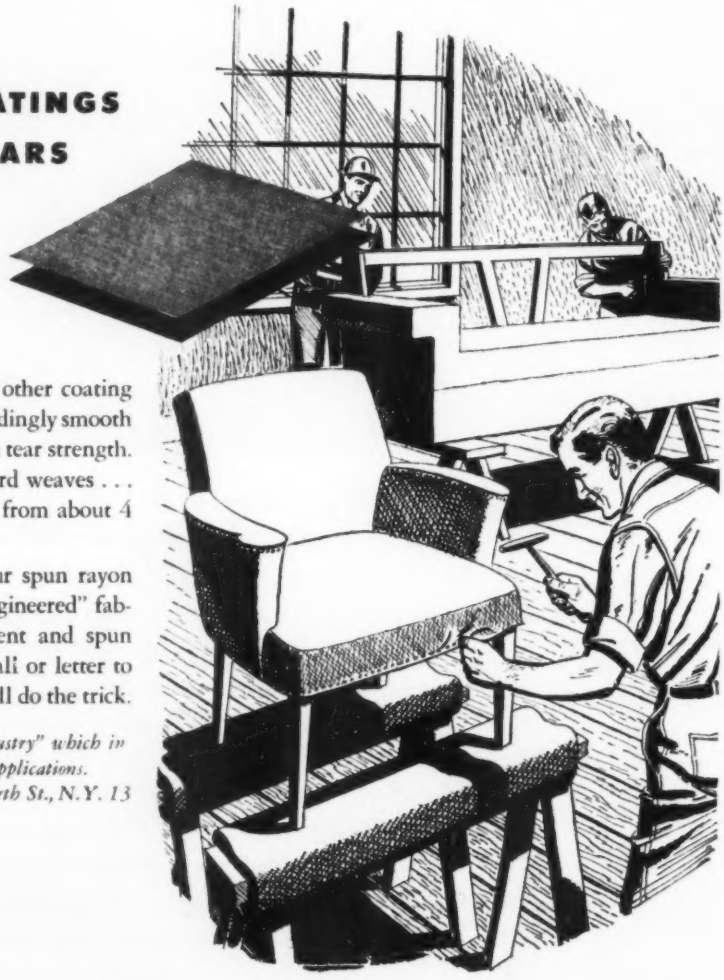
IMPERIAL CHEMICAL INDUSTRIES LIMITED
Plastics Division, Black Fan Road, Welwyn Garden City, Herts, England.
U.S.A. enquiries to:—**J. B. HENRIQUES INC.,** *521 Fifth Avenue, New York 17, N.Y.*

P.545m

The uniformly high quality of Wellington Sears drills has established them in a wide variety of large-volume coating applications.

Smooth weave surface, high tear resistance, and tensile strength are important coating features of Wellington Sears sateen.

YOU GET SMOOTH COATINGS WITH WELLINGTON SEARS SPUN RAYON FABRIC



Already established as a solid favorite in the upholstery field, Wellington Sears spun rayon fabric is developing rapidly in other coating applications. It meets the need for an outstandingly smooth and clean coating surface that is also high in tear strength. The fabric is available in a range of standard weaves . . . widths up to 60 inches . . . and in weights from about 4 to 10 ounces per square yard.

Why not let us tell you more about our spun rayon fabric and other Wellington Sears "fiber-engineered" fabrics. These include filament rayon; filament and spun nylon, Orlon*, Dacron**; spun dynel. A call or letter to your nearest Wellington Sears sales office will do the trick.

Write for a free copy of "Modern Textiles For Industry" which includes pertinent information on fabric-and-plastic applications. Address: Wellington Sears Co., Dept. J-3, 65 Worth St., N.Y. 13

*DuPont's trademark for its acrylic fiber.
**DuPont's trademark for its polyester fiber.

Superior Fabrics for Coating and Laminating

Single filling ducks	Broken twills
Army ducks	Drills
Single and plied-yarn chafers	Sheetings
Special ducks	Nylon, rayon and other synthetics
Sateens	Lantuck non-woven fabrics
Twills	

Wellington Sears

A SUBSIDIARY OF WEST POINT MANUFACTURING COMPANY

FIRST In Fabrics For Industry

WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK 13, N. Y.

Offices In: Atlanta • Boston • Chicago • Detroit • Los Angeles • New Orleans • Philadelphia • San Francisco • St. Louis

SKETCHES LIKE THIS ONE teach school kids about color . . . how almost all color shades are derived from basic red, blue and yellow (plus black and white).

Polyester molders can use this same principle to keep color stocks at an absolute minimum. By stocking only the *basic* Ferro colors, you can color-mix on your own equipment almost any shade you want. No obsolete colors piling up, no surplus waste. But a definite reduction in material costs.

Let our color lab match your samples. We'll tell you the correct proportion of basic Ferro colors you need. Or, if you prefer, we will supply matched color pastes or dry colors, ready to use.

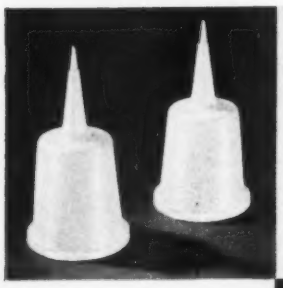
Write today for complete literature and a personal appraisal of your polyester color problem, in either pastes or dry colors.

FERRO

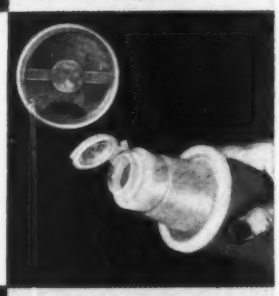
FERRO CORPORATION

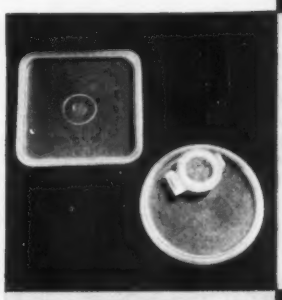
Color Division

4150 EAST 56th STREET • CLEVELAND 5, OHIO



NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!





Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Per Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ...and the best at molding polyethylene is Tupper!

TUPPER!
TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

Factories, Laboratories and Sales Offices:
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Showrooms: 225 Fifth Ave., N. Y. C.

Address All Communications To:
DEPARTMENT M-11.

Mrs. Tucker's foods get dependable shipments —plus effective trademark display with

Rheemcote

55-GALLON POSTER DRUMS

PERFECT INSIDE AND OUT!

INSIDE . . . Through constant research, Rheem continues to develop specially prepared container linings for products which cannot be shipped safely in ordinary steel containers. For the manufacturer of new products, Rheem laboratory facilities are fully equipped to test the product and to recommend a suitable lining.

and OUTSIDE . . . Rheemcote containers can be lithographed in any number of colors, any design, including halftones. Decorations like the diagonal stripe on this VELVET drum are possible only with the exclusive Rheemcote process. The high-gloss finish is tough, long-lasting.

Your product . . . your trademark gains extra prestige and new sales opportunities when dramatically presented in Rheemcote drums. Inside and out, Rheemcote offers a sure way to build new customers and new sales. Write for free colorful booklet on this powerful new advertising medium. Rheem Manufacturing Company, General Sales Offices, 570 Lexington Avenue, New York 22, N. Y.

SELL as you SHIP with Rheemcote DRUMS

RHEEM MANUFACTURING COMPANY • ***Manufacturing Plants in 22 Cities Around the World***

PLANTS AND OFFICES: BURLINGTON, LINDEN, NEW JERSEY • CHICAGO, ILL. • HOUSTON, TEXAS • NEW ORLEANS, LA. • NEW YORK, N. Y. NEWARK, RICHMOND, SAN FRANCISCO, SAN PABLO, SOUTH GATE, CALIF. • SPARROWS POINT, MD. • FOREIGN PLANTS: BRISBANE, FREMANTLE, MELBOURNE, SYDNEY, AUSTRALIA • BRISTOL, UNITED KINGDOM • BUENOS AIRES, ARGENTINA • HAMILTON, ONTARIO • LIMA, PERU RIO DE JANEIRO, BRAZIL • MILAN, ITALY • SINGAPORE

This is a standard vinyl electrical insulation . . .

This is a vinyl insulation for high temperature use

There are proved "Dutch Boy" Stabilizers for both of these compounds

Today, makers of vinyl electrical insulations are heavy users of three "Dutch Boy" stabilizers... Tribase, Tribase E, and Dythal.

Tribase and Tribase E, manufacturers find, give them the desired electrical properties plus the processing advantages that recommend these two stabilizers for standard insulations. Both give vinyls exceptional heat stability, eliminating gassing and other stabilizer breakdowns. And both can be dispersed easily throughout the formulation.

"Dutch Boy" Dythal, they find, does an outstanding job for high temperature vinyl insulation. Not only does it impart good electrical properties, but it also gives excellent heat stability in formulating vinyl insulation for high temperature use. Its low tinting strength, they say, makes bright colors possible. Manufacturers also find it's easy to disperse "Dutch Boy" Dythal . . . and easy to extrude compounds containing it.

Whenever a problem arises in your plant involving vinyl insulation stabilization, consult our technical staff. For information on "Dutch Boy" Tribase, Tribase E, and Dythal, write us.

"Dutch Boy" Stabilizers

PRODUCT	USE
	Electrical and other compounds requiring high heat-stability
	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Dibasic Lead Phosphite)	Outstanding for heat and light in all opaque stocks, including plastisols and organosols
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

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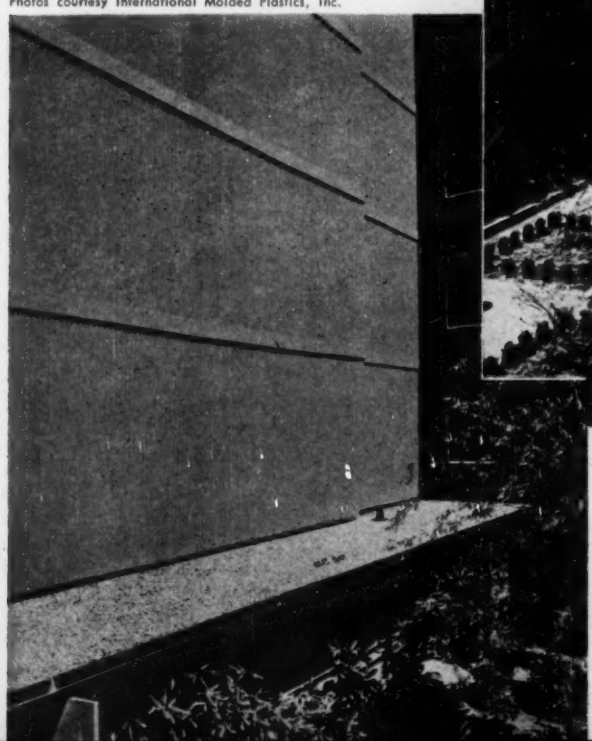
MODERN PLASTICS

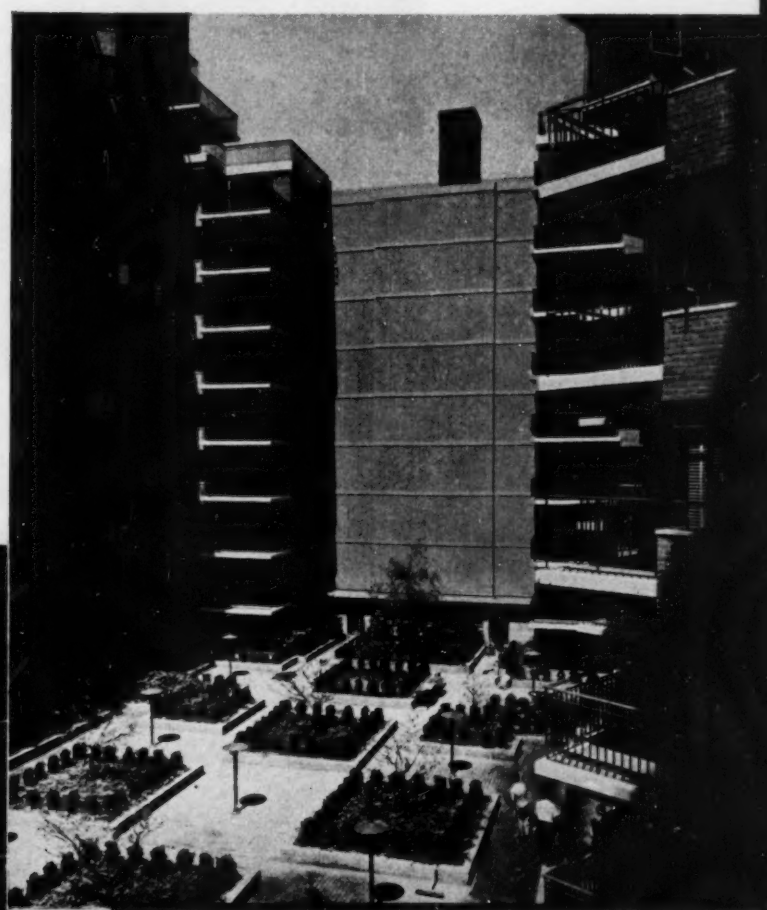
BOON TO BUILDERS . . . are light-transmitting structural panels of reinforced plastics and acrylics. They show thru strength a fast growing market. Standards are coming

ONE of the major improvements in architectural design in recent years has involved an increasing use of corrugated and flat plastics structural sheeting. Both translucent and transparent sheets have proved successful as a replacement for glass in standard glazing applications and to supersede metal and other materials in entirely new creative and light-transmitting architectural and industrial applications.

The possibilities for the two major materials in this category—acrylic and fibrous glass-reinforced plastics—are almost unlimited. Attractive in appearance, they make possible unusual effects in exterior architectural design, modern interior planning, and large displays and signs. Possessing outstanding physical properties, they can be used in economical

Photos courtesy International Molded Plastics, Inc.





FACTORY CONCEALER

Fibrous glass-reinforced plastic structural sheet is used by the builders of a modern apartment house in erection of an unusual —but functional—translucent wall (above). The 8-story partition, bolted in place to a specially built steel frame (left), screens off the sight of an unattractive adjoining factory building—without shutting off light from the windows of the factory

MODERN PLASTICS Source Chart of Plastics Glazing and Structural Panels

COMPANY	TRADE NAME	MATERIAL	COLORS[1]	CORRUGATIONS[2] in.	SHEET SIZE[3] Width in.	SHEET SIZE[3] Length in.	WEIGHT[4] oz./sq. ft.	THICKNESS[4] in.	GLASS CONTENT[5] oz./sq. ft.	ACCESSORIES MANUFACTURED[6]
ALSYNITE CO. OF AMERICA 4654 De Soto St. San Diego, Calif. (branch plant: 2420 Gallia St. Portsmouth, O.)	Alsynite	Reinforced Plastics	Aqua, opal, maize, rose, moonglow, light green, leaf green, translucent clear (awning colors-red, green, blue, yellow, and pearl) (shower door colors - green, blue, pink, white, and yellow)	1¼ (stand.) 1¼ (deep 2⅝ 2.67 3 (stand.) 3 (deep) 4.2 Flat	26 26, 34, 40 35 26 42 24, 34	8 8, 10, 12 8 8 8, 10, 12 4, 8	6 8 11	0.045 0.060 0.090	1½ 2 3	Mastic; other accessories available through distributors
BARCLAY MFG. CO., INC. 385 Gerard Ave. New York, N.Y.	Barclite	Reinforced Plastics	Blue, yellow, gray, clear, white, rose, spray green, crystal green	1¼ 2½ 4.2 Flat	26-42	8, 10, 12	8	0.062	2	Molded rubber stripping, corrugated wood strips, extruded moldings
CHEMOLD CO. 2908-10 Broadway Santa Monica, Calif.	Chem-O-Glas	Reinforced Plastics	Dark green, copper, yellow, blonde, and white opaque	Ribbed design, 4 in. module Flat	32¼ 32	8 8	6½ 8½ 12 17 27 40	0.031 0.062 0.093 0.125 0.187 0.250	2 3 4 5-6 8-9.5 11-14	Accessories available through distributors
CORRULUX DIV. LIBBEY-OWENS-FORD GLASS CO. P. O. Box 20026 Houston, Tex.	Corrulux	Reinforced Plastics	Skylight blue, skylight green, coral, forest green, skylight yellow, maxlite, ivory, red, white, yellow	1¼ 2½ 2.67 4.2 Flat	26-42	to 12	8 12	0.062 0.093	2 3	Horizontal and vertical bevel closure strips, scallopped wood moldings, extruded and formed aluminum moldings and shapes
DEPEW MFG. CORP. Duffy Ave. Hicksville, L.I., N.Y.	Durolux	Reinforced Plastics	Light green, dark green, standard blue, dark blue, standard yellow, orchid	1¼ 2½ 2.67 4.2 Flat	26 26, 27½, 33½ 35 42 30, 36	6-12	8	0.070	2	Closure strips; other accessories available through distributors
EASTERN INDUSTRIAL SERVICE, INC. 17 Day St. Cambridge, Mass.	Thermoglare	Extruded Acrylic	Blue-green, frost-white	Flat	Cut to size		6 8	0.060 0.080	-------	----------
FIBARLITE CORP. 646 N. Robertson Los Angeles, Calif.	Fibarlite	Reinforced Plastics	Aquamarine, blue, gold, green, sand, tan, white, and red	1¼ 2½ 4.2 Flat	26 24, 30	8, 10, 12	7½	0.060	2	Corrugated redwood molding, mastic strip, lead head nails
FIBERPANE CORP. Route 1, Box 1058 Bellevue, Wash.	Fiberpane	Reinforced Plastics	Blue, light green, dark green, yellow, and white	1¼ 2½	26, 34	8, 10, 12	7½	0.060	2	Accessories available through distributors
INTERNATIONAL GLASS FIBRES CORP. 3326 Greenmount Ave. Baltimore, Md.	Fibrelux	Reinforced Plastics	Skylight green, dark green, skylight blue, dark blue, yellow, red, white, clear	1¼ 2½ 2.67 4.2 Flat	26 30 30 42 48	to 10 to 10 to 10 to 12 8	8	0.083	2	Accessories available through distributors
INTERNATIONAL MOLDED PLASTICS, INC. 4387 W. 35 St. Cleveland, O.	Structo Glas	Reinforced Plastics	Yellow, blue, orange, ivory, green, light blue, dark green, red, dark yellow, emerald, pink, white	1¼ 2½ 2.67 4.2 Flat	26, 36 26, 27½, 33, 40 33¾, 35 42 16, 24, 32, 48	4 to 14	8 10	0.062 0.093	2 3	Rubber filler strips, wood & metal contour moldings, aluminum nails, clear mastic
ALEXANDER H. KERR & CO. INC.	Rippolite	Reinforced Plastics	Dark green, light green, blue, light blue, yel-	2½	26, 27½, 34, 40	8, 10, 12	7	0.062	2	Mastic sealers, partition molding,

Cleveland, O.			dark yellow, emerald, pink, white	4.2 Flat	42 16, 24, 32, 48				aluminum nails, clear mastic
ALEXANDER H. KERR & CO. INC. 3440 Wilshire Blvd. Los Angeles, Calif.	Rippolite	Reinforced Plastics	Dark green, light green, blue, light blue, yellow, rose, clear	2½	26, 27½, 34, 40	8, 10, 12	7	0.062	2	Mastic sealers, partition molding, metal closure strips, contour molding, rubber closure strips, flashings
PARKER MFG. CO. 1466 F St. San Diego, Calif.	Parlite	Reinforced Plastics	Green, blue, yellow, rose, aquamarine, ivory, neutral, poppy	2½ Flat	26, 27½, 34, 40, 41 30-42	6, 8, 10, 12	8 8	0.062 0.078	1⅜ 2¼	Mastic, lacquer, nails, weather strips
PLEXOLITE CORP. OF CALIF. 4223 W. Jefferson Blvd. Los Angeles, Calif.	Plexolite	Reinforced Plastics	Green, gold, blue, slate, coral, yellow, dawn, aqua, jade, clear, emerald, snow	1¼(s) 1¼(d) 2½ 2.67 4.2 Flat	24, 26, 30, 36 24, 26, 30, 36 26, 34, 40 35 42 24, 36	2, 3, 4 5, 6, 8 10, 12	8 11 20	0.062 0.093 0.188	2 3 5	Corrugated aluminum ridge roll, end wall flashing, sidewall flashing, wood and rubber corrugated strips, rubber vertical strips, aluminum corrugated rolls, nails, and washers
PLYMOLD CO. 2707 Tulare Ave. Burbank, Calif.	Plymolite	Reinforced Plastics	Green, yellow, red, gray, gold, light blue, dark blue, white opaque	1¼ 2½ 4.2 Flat	26 26, 27½, 34 42 24, 26, 36	8, 8½, 10, 12	5¼ 7½ 11⅔ 15	0.047 0.060 0.093 0.125	1⅓ 2 3 4	Corrugated and crested redwood furring, endwall and sidewall flashing, ridge flashing, nails, mastic
REPLAC CORP. 21830 St. Clair Ave. Cleveland, O.	Korlite	Reinforced Plastics	Chartreuse, blue, green, light blue, light green, yellow, pink, red	1¼ 2½ 2.67 4.2 Flat	26-42	to 12	8	0.062	2	Accessories available through distributors
RESOLITE CORP. Zelienople, Pa.	Resolite	Reinforced Plastics	Pale green, dark green, azure blue, sky blue, ice blue, red, coral, yellow, ivory, white, semi-clear	1¼(s); 1¼(d) 2½ 2.67 4.2 Flat	26, 31, 36 26, 27½, 33, 40 33¼, 35 42 24, 30, 36, 42	1 - 12 1 - 13 1 - 13 1 - 13 1 - 8	8 11	0.065 0.097	2 3	Mastic, sidewall and endwall flashings, wood and rubber corrugated filler strips, extruded aluminum shapes, assorted fasteners.
ROHM & HAAS CO. Washington Sq. Philadelphia, Pa.	Plexiglas	Cast Acrylic	Dark red, light red, amber, yellow, dark green, light green, dark blue, light blue, white, clear colorless	1 2½ 2⅞ 2.67 4.2 Flat	36 to 100	3 to 10	6 to 48	0.060 to 0.500	-------	----------
SOUTHERN PLASTICS CO., INC. 408 Henderson St. Columbia, S. C.	----------	Extruded Acrylic	Dark red, light red, amber, yellow, dark green, light green, dark blue, light blue, white, clear colorless	Corrugations on special order Flat	36	to 10	3 to 12	0.030 to 0.125	-------	----------
THE SPUN LITE CORP. 3788 N.W. 52 St. Miami, Fla.	Spun-Lite	Reinforced Plastics	Yellow, coral, blue and green (standard), white, clear, light and dark in all	1¼	to 52	to 100	6 8	0.055-0.065 0.055-0.065	1⅓ 2	Accessories available through distributors
STRUCTURAL PLASTICS CORP. 25 N. Duke St. York, Pa. (produced by Modern Air Moldings, Inc.)	Modernite	Reinforced Plastics	Light green, dark green, light blue, dark blue, yellow, light red, dark red, white, natural	1¼ 2½ 2.67 4.2 Flat	26 26, 27½, 33⅓ 33⅓, 35 to 42	to 12	9	0.062	2	Mastic, rubber filler, strips, aluminum contour moldings, all types of fasteners
WRIGHT MFG. CO. P. O. Box 6567 Houston, Tex.	Sturdalite	Reinforced Plastics	Green, sky blue, dark green, yellow, salmon, cream white, untinted	1¼ 2½ 2.67 4.2 Flat	26 26, 27½, 33⅓, 40 33⅓, 35 42 40	6-12 9	8 8	0.062 0.093	2 3	Trim and joint accessories

[1] Standard colors only; custom colors available upon request

[2] Standard corrugations sizes; special sizes and shapes also available.

[3] Standard sheet sizes; special sizes cut to order.

[4] Weight of sheet per standard thicknesses

[5] Fibrous glass content of reinforced plastic sheet per standard thicknesses

[6] Accessories manufactured by producers. Other accessories such as nails, mastic, sealer, etc. available through dealers.

NURSERY NATURAL

Plants and flowers thrive in greenhouses built of shatterproof reinforced plastics panels. The easy-to-install, easy-to-maintain sheets protect plants from sun rays which cause leaf burn

Courtesy Alsynite Co. of America

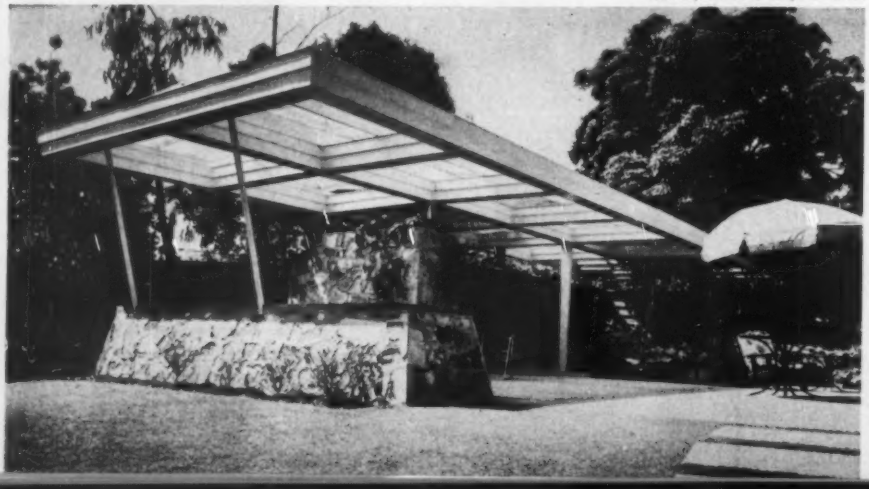
NESTS WITH METAL

Courtesy Resolite Corp.

Corrugated plastic building panels, designed to nest with standard corrugated metal sheets, are installed along aluminum sidewalls with a minimum of framing

TERRACE SHADE

Courtesy Plexolite Corp. of Calif.



Modern outdoor living is enhanced by decorative corrugated reinforced plastic terrace roof. Roof tempers the sun's rays so that annoying glare is eliminated

and functional installations that will stand up under severe service conditions.

The diverse markets that are open to the material have only been tapped. There is still a huge sales potential lying beneath the surface of each of these market areas—a potential that indicates a colossal business for the material within a very few years!

Expanding Markets

Translucent plastics structural sheets—both acrylic and reinforced plastics—are now enjoying a boom. Consider the expansion which has taken place only within the past 12 months in the markets for the structural reinforced plastics sheet alone.

According to a survey by Owens-Corning Fiberglas Corp., sales of translucent reinforced plastics structural sheet in 1953 will top 16 million sq. feet. Since last year's sales totaled only 8½ million sq. ft., it is small wonder that the industry is optimistic. By 1957, this sales figure could quite possibly more than triple itself to the astounding total of 49 million sq. feet.

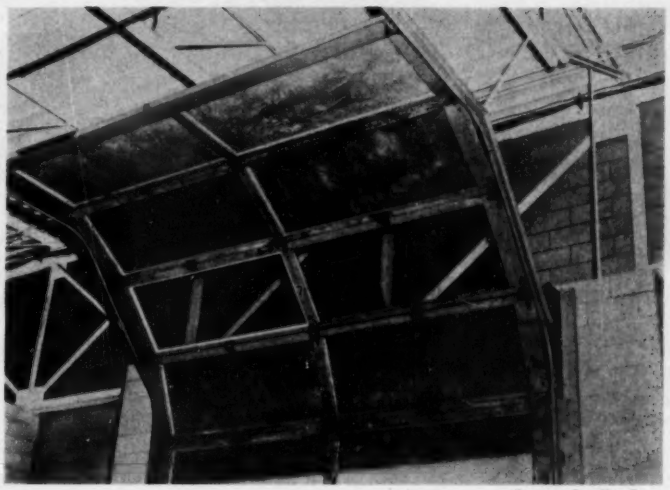
These figures are based on the *low* side of estimates; therefore they are conservative. Many factors are involved in the industry's plans which may result in an even larger sales volume.

One such factor is the current "do-it-yourself" trend, which represents an important potential market for the various reinforced plastics glazing materials.

This year, alone, it has been estimated that some 11 million week-end carpenters will spend upwards of $3 million for materials and supplies—and the "do-it-yourself" market is still on the up cycle of a boom period.

Since reinforced plastics glazing

GARAGE DOOR



Courtesy Resolite Corp.

Problems of breakage and maintenance are eliminated when overhead doors are glazed with shatterproof plastic sheet

STRUCTURAL SIGN

Courtesy Alsynite Co. of America

Light diffusing qualities of the colorful material open new horizons in the sign and display field

materials, by virtue of their ease of fabrication and installation, are particularly suited for "do-it-yourself" applications, most manufacturers are devoting a large part of their advertising and promotion effort towards grabbing a share of this expanding market.

There are, of course, several obstacles to be overcome, particularly those of price and distribution at the lumber yard dealer level. Most manufacturers are confident, however, that these problems are well on their way towards a solution.

Corrugated Sheet

Within the past few years, there has been a growing awareness on the part of architects and industrial design engineers of the advantages which plastics display over their two competitors—glass and corrugated aluminum. These advantages are many.

Plastics glazing and structural material is available in two forms—flat sheet or corrugated sheet. Flat sheet is used for conventional type windows or in specialized applications, such as the adaptation of flat acrylic sheet for glazing new or existing sashes or doors against cracking or shattering. It is the corrugated glazing material, however, which has proved the more popular of the two, primarily because the inherent characteristics of corrugated materials—greater transverse rigidity and strength—make for a more durable material per in. of thickness and for simpler fabrication on the job.

Corrugated material is sometimes considered more decorative than the flat sheet in exterior architectural applications and in displays. Since it is specifically designed to nest with corrugated metal walls and sidings, corrugated plastic glazing material can be quickly and economically installed without the need for special framing. Savings as high as 30% have been effected by using plastics instead of the conventional structural materials.

Both acrylic and reinforced plastics glazing and structural materials are available in the same standard corrugations as metal sheets, including these four basic sizes:

1¼ in. corrugations—pitch (distance between peaks of corrugations), 1.23 to 1.25 in.; depth (of valley between corrugations), ¼ to ⅜ in.; designed to nest with corrugated aluminum or galvanized iron sheet material.

2½-in. corrugations—pitch, 2.67 in.; depth, ½-in.; designed to nest with standard corrugated iron sheet material.

2.67-in. corrugation—pitch, 2.67 in.; depth, ⅞ in.; designed to nest

ROOM DIVIDER

Clever new effects in interior planning are made possible by using reinforced plastics structural panels as room partitions. Pastel shades of panels transmit warm glow to the rooms

Courtesy International Molded Plastics, Inc.

LIFETIME AWNING

Courtesy Ray-O-Lite Corp. of America

Crinkle-finish fibrous glass-reinforced plastics awnings are impervious to rain, sun, hail, or snow and do not require painting or other preservative treatment

SERVICEABLE COVERING

Courtesy Chemold Co.

Rectangular flat sheets of plastics structural material, in contrasting shades of yellow and blue, are ideal protective coverings for service counter and storage area

with corrugated industrial aluminum roofing and siding sheets.

4.2 in. corrugations—pitch, 4.2 in.; depth, 1 1/16 in.; designed to nest with standard corrugated asbestos sheet.

As the Source Chart (tear-out insert, between p. 88 and p. 89) indicates, these are the standard corrugations being produced by most of the manufacturers. There are, however, several variations in size which are available to fit special corrugated materials. There are also available variations in shape of corrugations, such as the 5V crimp reinforced plastic glazing sheet, produced especially to match and nest with standard 5V crimp metal roofing and siding sheets.

Production Methods

Most of the acrylic glazing material being sold today is a product of Rohm & Haas Co., Philadelphia, Pa. This company supplies the material either as flat Plexiglas sheet cast by standard methods or as corrugated sheet formed from the flat material. Rohm & Haas also supplies acrylic molding powder to Southern Plastics Co., Columbia, S. C., who extrude the material as corrugated sheet for special applications (see "Extrusions Cut Lighting Costs," p. 108), or as flat sheet sold to manufacturers to be formed. It is reported by Southern Plastics that extruding the material has resulted in a glazing sheet, which is claimed to be tougher and more economical than the cast sheet.

Reinforced plastics glazing and structural sheets—both flat and corrugated—are also produced by standard methods. Basically, the sheet is made from a lay-up of glass mat, impregnated and coated with polyester resin, catalysts, and color pigments, and sandwiched between two layers of cellophane and polyvinyl alcohol. A mechanical process is used to remove the air which has been dis-

Average Physical Properties of Reinforced Plastics Glazing and Structural Sheeting[1]

Tensile strength	*Flexural strength*	*Load bearing strength*	*Impact strength*	*Coefficient of expansion*	*Thermal conductivity*	*Visual light transmission*	*Specific gravity*	*Modulus of elasticity*
p.s.i.	*p.s.i.*	*lb./sq.ft. on a 4-ft. span*	*ft.lb./in. of width Izod unnotched*	*in./in./°C.*	*K factor*	*%*		*p.s.i.*
11,000	17,000	>100	10-15	2×10^{-5}	1.7	to 80-85[2]	1.5	1.4×10^{6}

[1] Average figures based on medium sheets weighing 8 oz./sq. ft. [2] Depending upon color

placed by the resin from between the layers of film, and the entire mass is then fused under heat and pressure into a solid sheet.

Variations exist, however, in the methods of applying heat and pressure. The low-pressure, hand lay-up method is the simplest and requires the lowest capital investment. In this process, the sheets are formed in aluminum or galvanized iron molds and are then passed through an oven for curing.

The high-pressure method, which requires a substantial capital investment, uses a heated press and matched heavy metal molds to form the sheet and an oven for the final cure.

Continuous Process

The third production method for reinforced plastics glazing material is the continuous process, in which the sandwich passes along a conveyor line. It is first sent into a special heating unit, from there into a forming unit where a series of rollers do the job of corrugating the material, and finally into a curing oven. By this method, sheets of reinforced plastics glazing material, up to 100 ft. in length, can be formed.

Although there are many bugs still to be ironed out in the continuous process, many leaders in the industry look upon it as a probable answer to the problem of price. As one supplier interviewed in the course of this survey put it, "The price of reinforced plastics glazing material will soon be lowered. While economics are favorable in skylighting and sidewalling installations, the product is high priced at the normal dealer level.

"What is going to happen within the next few years is that many of today's marginal producers will either be swallowed up or will combine with larger companies having more adequate finances and better know-how. As a result, research on the continuous process will be more intense and we can expect to see its early perfection—from the production standpoint as well as the maintenance of a quality product. As demand for plastics glazing and structural materials increases, volume production, based on the continuous process, will become a reality, and prices will be forced down."

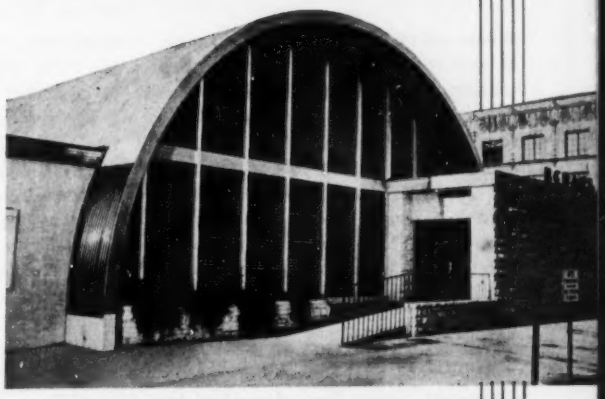
Average physical properties for various reinforced plastics structural

HURRICANE SHUTTER

Courtesy American Cyanamid Co.

Rolling down over a window like a roll-top desk, reinforced plastics awnings become weather-resistant hurricane shutters that effectively protect the home's interior

BUILDING FRONT



Translucent plastics, used for the facade of a modern building, complement the conventional structural materials to create a new type of architectural beauty

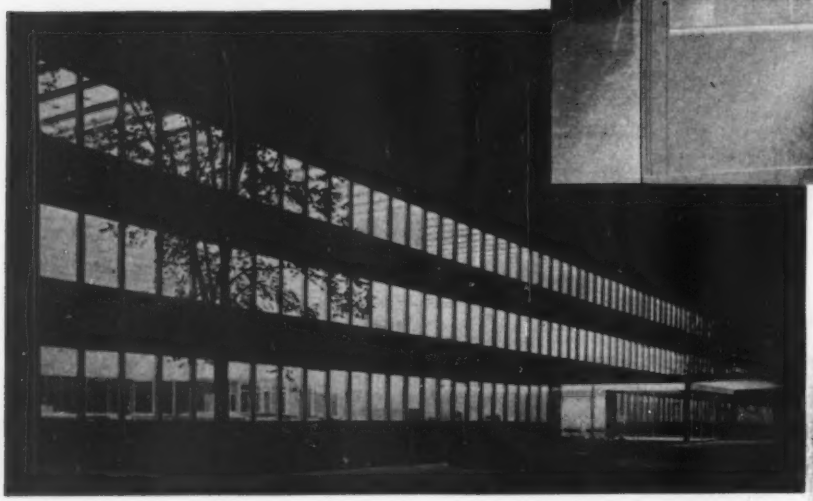
Courtesy Corrulux Div., Libbey-Owens-Ford Glass Co.

DAY-NIGHT DISPLAY

Courtesy Rohm & Haas Co.

By day, corrugated acrylic sign is a neat, attractive display; by night, the entire facade is made luminous—and even more eye-appealing—by an effective use of backlighting

BRIGHTER OFFICES



Corrugated acrylic luminous ceilings (above), installed throughout a large office building (left), eliminate eyestrain and poor employee performance by providing glare-free, completely diffused illumination

sheets are tabulated on p. 90. Because of the fact that reinforced plastics glazing and structural sheets are comparatively new, it would be well to review their background and their current problems before discussing the application and installation advantages which result from these properties. The acrylics and their outstanding features will be treated further on in this article.

Standardization

Since each of the production processes which have been described for reinforced plastics glazing sheet result in a different quality product and since most manufacturers have developed individual variations in each process, it would be difficult to give any over-all specifications for the material. The number of manufacturers of reinforced plastics glazing sheet has more than doubled (see Source Chart, tear-out insert, between p. 88 and p. 89) within the past few years and a handful more have already announced their intentions of going into production.

As a result of such expansion in so short a time, the industry has found itself in a state of confusion as far as standards for physical properties are concerned. To combat the confusion, a Standards Committee of the S.P.I. is presently at work setting up products standards which can apply to the entire industry—including test specifications for load bearing strength, light transmission qualities, chemical resistance, etc.

By averaging out the data on physical specifications received by the editors of MODERN PLASTICS during the course of this survey, the general properties chart (see p. 90) for reinforced plastics structural sheet has been developed. Since there are no uniform standards in the industry, a comparative report on the physical properties of each of the products listed in the Source Chart would serve no worthwhile purpose. According to one manufacturer, the manner of preparation of a specimen in a tensile strength test can affect the results by as much as 30 percent. The figures in this general properties chart, therefore, are presented by the editors of MODERN PLASTICS with an eye to the eventual setting up of standards as a protection to the public and as a means of strengthening the industry by encouraging the sale of technically sound products.

From an architectural and engineering viewpoint, the advantages that derive from the physical properties of reinforced plastics glazing material are outstanding.

Depending on the shade of color which is used, the average light transmission of the material is from 60 to 75% of visible light rays. Lighter shades are reported to give light transmission values up to 85% visible light rays. As a matter of fact, useful light transmitted through the sheet is actually much greater than that obtained through clear glass, because of the efficient action of the material in diffusing light. At the same time, the soft diffused glow greatly reduces glare and, thereby, improves lighting conditions for work.

Advantages

The sheets are shatterproof, exceptionally strong, and capable of standing up under severe outdoor exposure without warping, cracking, buckling, or crazing. After prolonged exposure, as with most other materials, there will be a certain small amount of fading with today's products.

The plastic sheet is, in addition, inert in the presence of most mild acids and mild alkali solutions—including chlorine gas, hydrogen sulfide

(*Continued on p.* 193)

What You Should Know About

PLASTICIZERS FOR VINYLS

by H. S. Bergen,* Elmer E. Cowell,** and Walter Waychoff†

Last month's article under the above title pointed out the importance of plasticizers to vinyl chloride film and sheeting. The present article covers plasticizers for molding and extrusion compounds. Coming: Plasticizers for vinyl dispersions.

CONSUMPTION of compounded polyvinyl chloride and vinyl chloride copolymers was 500 million lb. in 1952, with molding and extrusion material representing about one-third of the total. This is the largest single classification and the fastest growing, having taken the lead from sheeting and film.

Because of the wide variety of properties desired in extruded end products—wire and cable insulation, garden hose, gaskets, window spline, clothes line, tubing, and film—the problems facing the compounder are complex. He must consider many factors, physical and economic, in choosing raw material components for the given application as well as the most efficient means for compounding and extruding.

Extrusion Raw Materials

Straight polyvinyl chloride resins of various particle sizes, shapes, and molecular weights, as well as copolymer vinyl chloride-vinyl acetate resins, are available for extrusion compounding. Resin choice depends primarily upon the method of compounding and the different efficiencies each resin demonstrates in a particular processor's plant. Blending time, extrusion rates, and quality and appearance of finished article depend to a great degree on the resin and the method of compounding. The resin, however, does not have as great an effect on physical properties of the plasticized compound as the choice of plasticizers.

Categories

Plasticizers offer the compounder the greatest latitude and opportunity to get the most out of his resin and equipment. Since plasticizers usually make up approximately one-third of a vinyl extrusion compound, it is obvious that upon their careful choice will depend the processing characteristics of the material as well as the properties of the final product.

Vinyl plasticizers are divided into two main categories—primary and secondary. Primary plasticizers are those which can be used as the sole plasticizers for a resin. Indications are that their use alone is rapidly giving way to the use of blends, in which each plasticizer contributes its property to "tailor" the material for a specific application. Secondary plasticizers must be used in conjunction with a primary plasticizer to obtain compatibility.

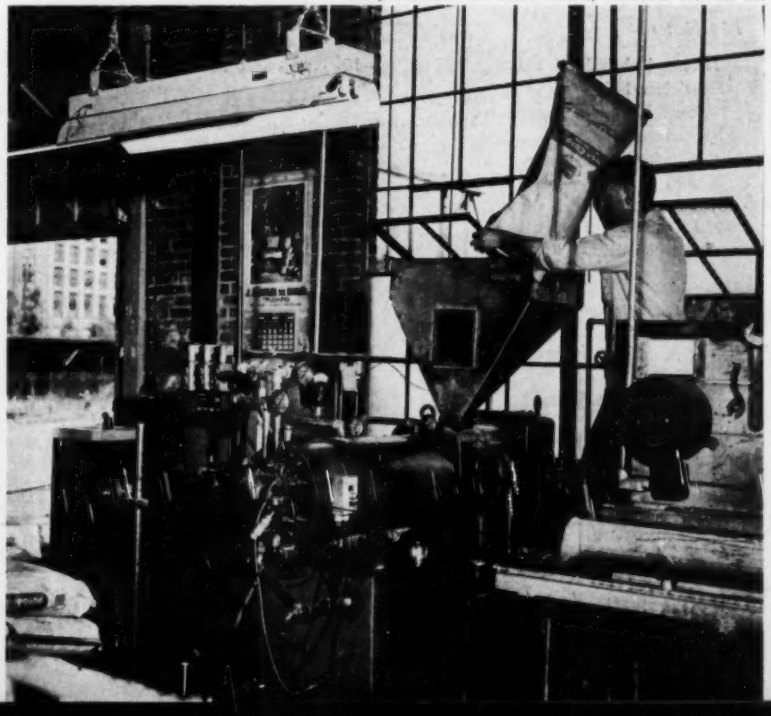
The most common primary plasticizers are the phthalates, phosphates, adipates, sebacates, and azelates. These are detailed, with the properties they impart to polyvinyl chloride, in Table I, p. 94.

Among the phthalates, the octyl esters are the most popular. Di-2-ethylhexyl phthalate is the most widely used plasticizer and, along with the other octyl phthalates (di-isooctyl phthalate, dicapryl phthallate, and di-n-octyldecyl phthalate) accounts for 50% of the total vinyl plasticizer market. The phthalates have a good balance of physical, chemical, and electrical properties, although their resistance to extraction by organic solvents and their processing characteristics leave something to be desired. Butyl benzyl phthalate is recommended for faster processing and improved resistance to organic solvents.

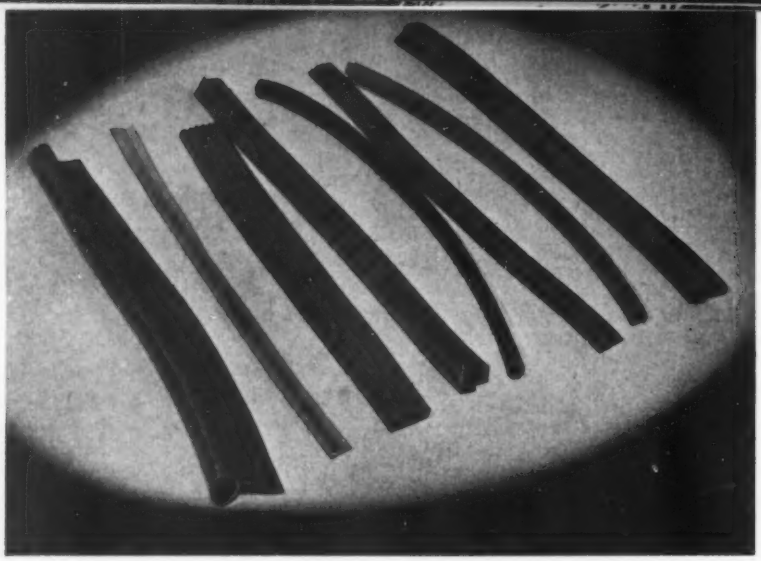
The phosphates are the second most popular group of products for

Dry blend being fed to extruder hopper is result of mixing resin, fillers, etc. with plasticizers and other liquid components in ribbon blender, then heating and drying

All photos with this article courtesy Monsanto Chemical Co.



* Organic Chemicals Div., ** Plasticizers Research Lab., and † Organic Chemicals Div., Monsanto Chemical Co.



Profile vinyl extrusions—tubing, welting, window spline, etc.—require fast-processing, low-cost, general-type plasticizers, are often extended with secondary plasticizers

vinyl plasticization, largely because of their flameproofing and fast processing action, together with their oil resistance. In addition, one phosphate ester (Santicizer 141) has been approved by the Bureau of Animal Industry for non-toxic vinyl applications.

The esters of aliphatic dibasic acids are excellent low temperature plasticizers. Their relatively high cost, slow processing, and high extraction by organic media are their main disadvantages.

Secondary Plasticizers

The use of secondary plasticizers for polyvinyl chloride and its copolymers has been increasing in the past few years, largely because of advances in the technique of plasticization.

Table I—Types and Properties of Typical Primary Plasticizers[1]

Plasticizer	*Low temp. flex.*	*Volatility*	*Resistance to extraction*		*Flame-proofing*	*Price range*
			H_2O	*Kerosene and oil*		
Phthalates	*°C.*	*% Plas. Lost S.P.I. Act. Car.*				
D.O.P. (di-2-ethylhexyl phthalate)	−36	4.5	Good	Poor	No	Medium
D.I.O.P. (diisooctyl phthalate)	−35	3.9	Good	Poor	No	Medium
Di-n-octyldecyl phthalate	−45	1.8	Good	Poor	No	Medium
Dicapryl phthalate	−33	5.0	Good	Poor	No	Medium
Santicizer-160 (butyl benzyl phthalate)	−25	11.4	Good	Good	No	Low
Dibutyl cellosolve phthalate	−36	5.4	Fair	Poor	No	Medium
Phosphates						
Tricresyl phthalate	−10	0.7	Good	Good	Yes	Low
Santicizer-140 (cresyldiphenyl phosphate)	−16	3.5	Good	Good	Yes	Low
Santicizer-141 (alkylaryl phosphate)	−37	5.8	Good	Fair	Yes	Medium
T.O.F. (tri-2-ethylhexyl phosphate)	−60	7.9	Good	Poor	Moderate	High
K.P.-140 (tributoxyethyl phosphate)	−60	7.3	Good	Poor	Moderate	High
Low Temperature Types						
D.O.A. (di-2-ethylhexyl adipate)	−60	10.0	Good	Poor	No	High
D.O.S. (di-2-ethylhexyl sebacate)	−60	1.3	Good	Poor	No	Very high
Di-2-ethylhexyl azelate	−60	5.2	Good	Poor	No	Very high

[1]Formula: PVC 60%, plasticizer 40%.

One important class of secondary type plasticizers is the polyester or polymeric. It may be argued that these belong under the primary type plasticizers, but because of the common practice of using them in conjunction with primary plasticizers they have been placed in the secondary group. The polymeric types are usually long-chain esters of dibasic acids and polyhydric alcohols. They possess low volatility and resistance to extraction by solvents and are used where these properties are desired. In general, they possess poor low temperature flex and poor processability.

The ricinoleates and tetrahydrofurfuryloleate are commonly used low temperature type extenders. These products possess excellent low temperature properties but have high migration and extraction tendencies.

The polyethylene glycol dialkyl esters impart excellent low temperature characteristics and other good general properties.

By-products or derivatives of the oil industry are commonly used where excellent electrical properties and cost are important factors. These products are the least expensive of all the vinyl plasticizers and are finding considerable use even though they are rather high colored.

Other secondary type plasticizers include hydrogenated terphenyls, chlorinated derivatives, and some nitrated compounds.

Stabilizers, Fillers, etc.

Lead compounds are the most commonly used stabilizers for polyvinyl chloride, especially in the electrical field. Other metallic compounds are widely used and recently the newer epoxy stabilizer-plasticizer compounds have been quite promising.

Fillers include calcined clays for electrical compounding; the calcium carbonates and calcium silicates are widely used for other applications.

Pigments include both organic and inorganic types.

Salts of long-chained aliphatic acids are commonly used as lubricants in vinyl compounding.

Applications

Vinyl compounds are widely used for wire coating. Last year approximately 100 million lb. of compound, or about 60% of the molding and extrusion total, went into this application. The market is still growing for building wire, telephone drop wire, appliance cords, and aircraft wiring. Typical formulations for various wire insulations are listed in Table II.

Table II—Formulations[a] for Vinyl Wire Coatings

Raw material	*S.P.T.*	*Underwriters Designation* 60° T. & T.W.	*80°*	*105°*
Polyvinyl chloride	100	100	100	100
Dioctyl phthalate	—	40	—	—
Butylbenzyl phthalate (Santicizer 160)	25	—	—	—
Tricresyl phosphate	15	—	55	12
Polymeric type[b]	10	—	—	50
Extender type[c]	10	18	—	—
Tribase	7	7	7	7
Lubricant	1	1	1	1
Clay	30	22-27	20	20

[a]Formulations given are in parts by weight of the various components.
[b]Such as Paraplex G-25, Paraplex G-50, or Glyptal 2557.
[c]Such as Chlorofin 42-S, Chlorowax 40, Panflex BN-1, or HB-40.

It will be noted from reviewing the formulations that the volatility of the composition used for the higher temperature wire is reduced by using lower volatile plasticizers in the formulation.

Other cable applications include the coating of a vinyl jacket over a polyethylene insulated wire for coaxial cable insulation. For this application it is necessary to use certain specific high molecular weight polymeric plasticizers such as Paraplex G-25, since the use of any other plasticizer results in migration of the plasticizer from the vinyl into the

Extruded hose and calendered pool and ball have high tensile plasticizer

Table III—Formulations[a] for Garden Hose

Raw material	*Clear hose*	*High quality opaque hose*	*Medium quality opaque hose*
Polyvinyl chloride	100	100	100
Dioctyl phthalate	20	22	22
Butylbenzyl phthalate (Santicizer 160)	15	15	20
Low temperature type[b]	10	12	—
Extender type[c]	—	—	15
Calcium carbonate filler	—	25	75-100
Dyphos	—	5	5
DS 207	—	0.5	0.5
Paraplex G-60	2	3	3
S-52	2	—	—
JCX	1	—	—

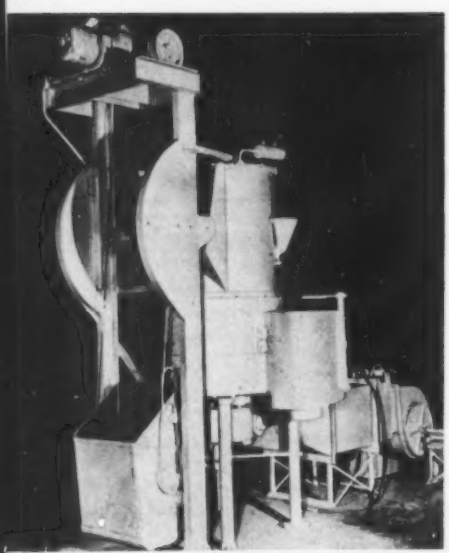
[a]Formulations are in parts by weight of the various components.
[b]Such as di-2-ethylhexyl adipate, diisooctyl adipate, or di-2-ethylhexyl azelate.
[c]Such as HB-40 or Chlorowax 40.

Table IV—Formulations[a] for Refrigerator Gaskets

Polyvinyl chloride	100	100
D.O.P.	34	18
Alkylaryl phosphate (Santicizer 141)	12	—
Polymeric[b]	17	20
Butylbenzyl phthalate (Santicizer 160)	—	25
Calcium carbonate	50	75
Paraplex G-60	3	3
Dyphos or B.C.W.L.	5	5
DS-207	0.5	0.5

[a]Formulations are in parts by weight of the various components.
[b]Such as Paraplex G-50.

Vinyl for wire coating is formulated with plasticizers as shown in Table II



Typical speed-muller installation for the dry blending of vinyl compounds

polyethylene, resulting in poor electrical properties of the primary insulation.

The use of polyvinyl chloride for garden hose has been increasing very rapidly and should continue to do so for the next few years. The approximately 250 million ft. of vinyl garden hose made in 1952 accounted for about 15% of extruded vinyl materials. Plasticizers for this application should be non-leachable and light stable, with good low-temperature properties and with sufficiently high tensile strength to impart high bursting pressures. Typical formulations are given in Table III.

The use of vinyl chloride compounds in refrigerator gaskets requires the use of low-odor, non-migrating type plasticizers. Consequently, for this application, low-odor monomerics of low migration (D.O.P. and Santicizer 160) and polymerics are employed. The monomerics improve processing and rate of extrusion. Typical formulations are listed in Table IV.

The use of vinyl chloride compositions in food wrappings, blood transfusion tubing, beer tubing, and milk tubing has required the approval of plasticizers by the Bureau of Animal Industry and the Food and Drug Administration. To date, five plasticizers have been approved. These are Santicizer 141, Santicizer B-16, Santicizer E-15, diisobutyl adipate, and acetyl tributyl citrate. Typical formulations are listed in Table V.

Other profile extrusions such as welting, window spline, and clothes line required the use of fast processing, low cost, good general type plasticizers. These are commonly extended with secondary type plasticizers to further decrease the cost. Typical formulations are given in Table VI.

A field which is slated for expansion is that of extruded blown vinyl film. For this application a resin of good particle size without hard high molecular weight particles is required. The plasticizing action must be excellent to obtain the high degree of stretch required. Furthermore, adequate mechanical control of temperatures and air stream is of utmost importance. Typical formulations are listed in Table VII.

Compounding and Extruding

There are essentially two methods of preparing vinyl formulations for extrusion: Banbury mixing followed by roll milling, sheeting off, chopping, or the newer method of dry blending.

Banbury operation power requirements and fusion time of a vinyl compound are affected by the plasticizers used. Through the proper selection of a plasticizer formula and operation procedures, optimal fusion times and horsepower requirements can be developed as shown by studies.[1] Subsequent plant experience has demonstrated that it is possible to increase Banbury efficiency either by producing more batches per day or producing greater quantities with

[1] "Vinyl Plasticizers—Effect on Processing Polyvinyl Chloride in Banbury Mixers," by H. S. Bergen and J. R. Darby, I & EC, Vol. 43, Page 2404 (October 1951).

Table V—Formulations[a] for Non-Toxic Compounds

Polyvinyl chloride resin	100	100
Alkylaryl phosphate (Santicizer 141)	—	25
Butylphthalyl butylglycollate (Santicizer B-16)	50	25
Calcium ricinoleate	2	2
Zinc stearate	0.5	0.5

[a]Formulations are in parts by weight of the various components.

lower power consumption and lower batch temperatures.

Dry blending is an inexpensive method of preparing compounds for extrusion. It requires only a jacketed ribbon blender which is within the reach of the small extruder. The method consists of mixing the resins, fillers, lubricants, stabilizers, and pigments with plasticizers and other liquid components in a ribbon blender, applying heat, and drying the mass so that the final product is a dry, free-flowing, sandy powder of uniform composition. This powder is a complete formulation ready for the extruder hopper.

The advantages of the dry blend process in the manufacture of extruded vinyl products is therefore apparent: low equipment cost and low conversion costs with increased extrusion rates, minimization of heat history in the production of extruded products, economy and efficiency in material handling, and uniformity of finished product.

The operation of dry blending is not so simple that mere stirring of ingredients will accomplish the desired results. Different resins and plasticizers require variations of incorporating and temperatures of drying.

Primary factors affecting the rate and efficiency of the dry blend process are the size and shape of the resin particle and the choice of plasticizers. Certain resins, such as Opalon 300 and Geon 101EP, are well suited for the dry blend process. The size and shape of the particles permit the absorption of the plasticizer and other liquid constituents so that a dry powder is formed. For practically all elastomeric extrusion formations this powder can then be blended with other solid components.

The effect of plasticizers in dry blending is more pronounced than the choice of resins. Most of the primary plasticizers dry blend without difficulty. The phosphates and Santicizer 160, which are high in solvency, dry-blend much more rapidly. In several cases, dry-blending times have been reduced 50% through the use of these plasticizers. The polymerics, which are low in solvency, dry blend slowly and require higher temperatures.

Some fillers and solid stabilizers contribute to faster drying time. Such stabilizers as Tribase and Dyphos exhibit a tendency to ball and have to be added to dryer mixtures of resin and plasticizer. The silicates, such as Plumb-O-Sil, shorten the drying time because of their high absorption. This is also the case with fillers. Those fillers which are of the coated, precipitated type tend to ball while those which are uncoated, having higher absorption, dry without balling. Particle size of fillers is also most important. Extreme microfine particle size fillers do not extrude well, and give rough extrusions. The larger particle size fillers give better results from dry blends.

Dry-blending temperatures vary

(*Continued on p. 204*)

Table VI—Fast Processing Formulations[a]

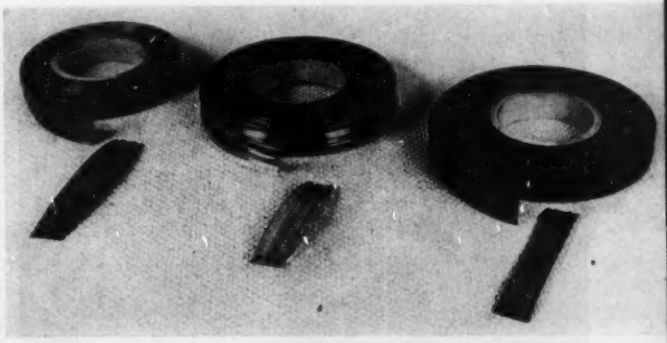
Raw material	*Clothes line*	*Window spline*
Polyvinyl chloride	100	100
D.O.P.	20	—
Butylbenzyl phthalate (Santicizer 160)	25	42
Alkylaryl phosphate (Santicizer 141)	—	—
Extender[b]	10	18
Calcium carbonate	50	100
Paraplex G-60	3	—
Mark XI or Ferro 1820 or BC-12	2	—
Mark XX or Ferro 903 or CH-14	1	—
DS-207	—	0.5
Dyphos	—	5

[a]All formulations are in parts by weight of the various components.
[b]Such as HB-40 or Chlorowax 40.

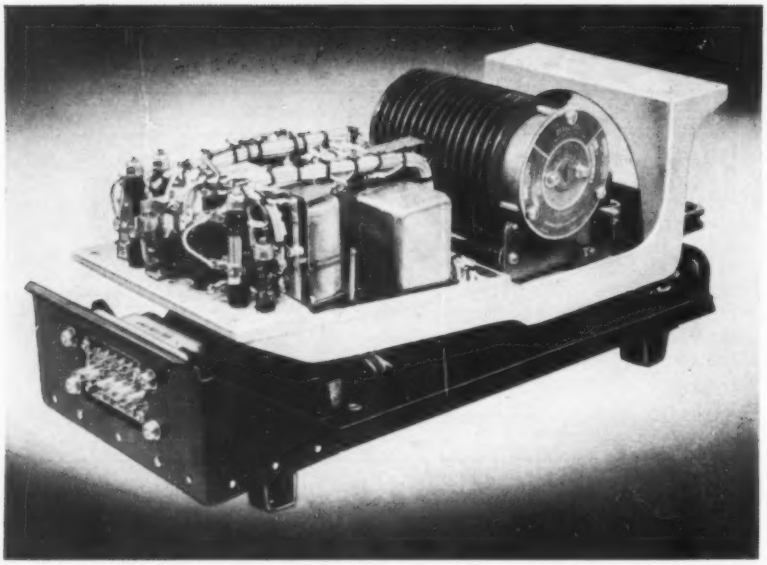
Table VII—Formulations[a] for Extruded Blown Film

Raw material	*High quality film*	*Quality film*	*Non-toxic film*
Polyvinyl chloride	100	100	100
D.O.P.	36	26	—
Alkylaryl phosphate (Santicizer 141)	10	—	20
Butylphthalyl butylglycollate (Santicizer B-16)	—	—	25
Butylbenzyl phthalate (Santicizer 160)	—	20	—
Paraplex G-60	3	3	—
Dibutyl tindilaurate	2	2	—
Calcium ricinoleate	—	—	2
Zinc stearate	—	—	0.5

[a]Formulations are in parts by weight of the various components.



Belting material extruded of vinyl. Proper compounding of plasticizer formulation makes for good product



Molded chassis, with components mounted in place, as it appears installed in control panel, shown here with cover removed. One-piece chassis permits more compact design

Alkyd Control Chassis

Eliminates 140 Assembly Steps

PRODUCTION of centralized electrical control systems for American aircraft is being speeded up with the help of molded fibrous glass reinforced alkyd. Westinghouse Electric Corp. announces that the use of one molded alkyd chassis has eliminated some 140 previous operations in this work.

The control panel approach to aircraft wiring brings numerous electrical components from throughout the plane to one spot on a single panel. The panel is designed as a removable "plug-in" unit that can be exchanged in a moment. The aircraft then can be returned to operation while the replaced panel is being serviced elsewhere.

According to Westinghouse, the use of control panels, begun in 1946 with a comparatively simple unit, has proved so satisfactory that today as many as four-fifths of the controls in a typical large plane are treated in this fashion.

Production of the panels, however, presents sizable problems. They are complex and require efficient electrical insulation; they must be able to hold up under installation and removal, hauling from place to place, and other rough treatment; their parts must be easily accessible for maintenance; and the assembly must be as small and light-weight as possible.

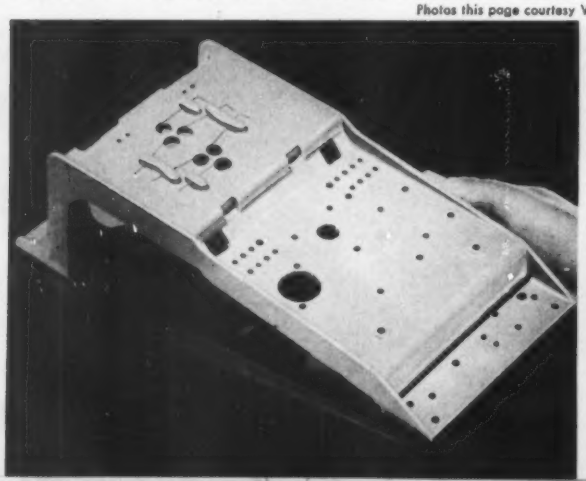
Using Plaskon alkyd 440A, a glass-reinforced product of Plaskon Div., Libbey - Owens - Ford Glass Co., Westinghouse engineers designed a single, tray-like chassis on which a major portion of the electrical components of a control panel are mounted. This molding replaces, in one step, an alternate design requiring assembly of some 140 separate parts. The chassis itself provides insulation of one connection from another, and is highly arc resistant. It made possible a rearrangement of components for easier wiring and assembly, and enabled designers to reduce the over-all height of the unit by 1¼ inches.

The alkyd molding, having extremely high tensile and impact strength, resulted in a rugged, damage-resistant chassis or base. This base, in turn, is mounted on shock absorbers in the handling tray of the panel to protect the parts during rough use.

The molders of the control panel chassis point out that, although it is used in this case for aircraft electrical systems, such alkyd moldings and the control panel approach to electrical systems are equally applicable to radio, radar, television—wherever similar problems are met.

Top (right) and bottom view (left) of aircraft control panel chassis molded of fibrous glass reinforced alkyd. Use of this plastic chassis, which is arc resistant and provides insulation between the various electronic components to be mounted on it, saved both weight and space

Photos this page courtesy Westinghouse Electric Corp.



The WHY and HOW of

Slurry Preforming

New "Aqua-glas" preform method for reinforced plastics offers speed, greater strength, and economy. Techniques were evolved from those used in pulp molding

by A. C. Weiss* and J. C. Williams**

EARLY in 1950 the Research and Development Div. of the Office of the Quartermaster General, Dept. of the Army, sponsored attempts to combine cellulosic fibers with fibrous glass. The aim was to reduce weight and cost, minimize material handling, and create a compact preform which would yield a more uniformly molded reinforced plastics structure.

As a result, a method has now been developed in which preforms are made by wet processing, techniques similar to those of the pulp molding industry. The filaments of glass are slurried in a water solution containing a small percentage of cellulosic fibers. This new "Aqua-glas" method of utilizing glass rovings to produce reinforced plastics molded items requires no separate treatment of the glass.

Photos this page courtesy U. S. Army Quartermaster Corps.

Locker molded for military use from cellulosic-fibrous glass slurry preform weighs half as much as fiber-faced plywood metal, costs less

Advantages

Production of "Aqua-glas" preforms has interesting possibilities for several reasons: first, the preform may be formed in 8 to 40 sec., depending on size; second, the preform is virtually self-supporting, whether large or small in size, intricate or simple in shape; and third, it may be removed at once from the preforming screen and transferred to the oven for drying.

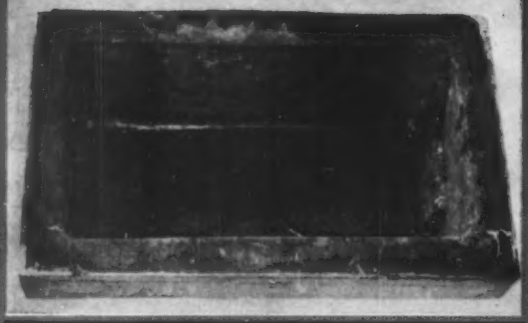
Varying ratios of cellulose fiber to glass were examined (Table I, p. 101) and a ratio of 20% cellulose to 80% chopped glass rovings was found to give the best results in comparative tests with straight glass fiber resin laminates. The wide and flexible range of ratios of glass to cellulose possible in the production of "Aqua-glas" preforms, provides a competitive price for applications which might be termed marginal; i.e., applications which economically could not be considered in all-glass reinforced plastics moldings, or in which the high physical values of all-glass would not be necessary or warranted.

"Aqua-glas" preforms composed of only 10% chopped glass rovings to 90% cellulose fibers produce moldings with engineering properties much higher than can be obtained with all-cellulose fiber moldings (see Table I).

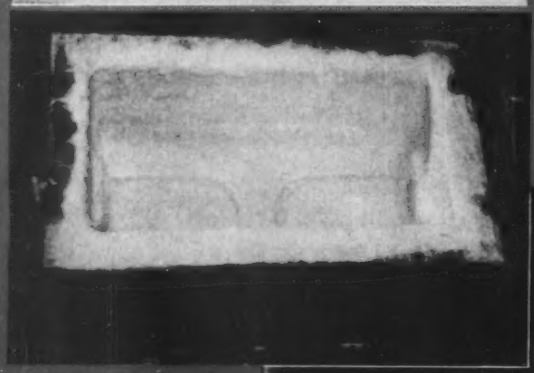
The Quartermaster Corps is evaluating this new preforming method in relation to military items of high potential production.

The Quartermaster Corps buys trunk lockers fabricated of vulcanized fiber-faced plywood with metal trunk corners and hardware at an approximate cost of $15.00 per unit. These lockers are designed for over-

* Research and Development Div., Office of the Quartermaster General, Dept. of the Army.
** Research director, Hawley Products Co., St. Charles, Ill.



As first step in production of reinforced plastics locker body, preform screen is carefully dimensioned and finished

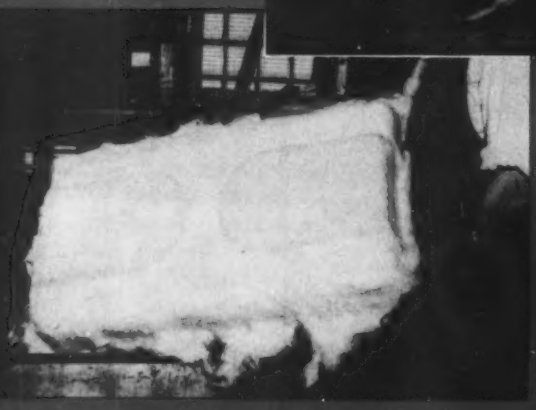


Inside view of locker body preform as it comes out of slurry tank reveals even distribution of reinforcing glass fibers

Outside view of locker body preform, after it has been properly dried, indicates its strength and shows the ease with which it can be handled

seas shipment of personal effects. The Quartermaster Corps also buys locker boxes made of solid lumber and of plywood. Both types are fitted with strap hinges, a hinged hasp, and a staple. These lockers are suitable only for stateside use and cost approximately $9.60. Seeking to improve on the above, a locker was designed for "Aqua-glas" preform molding that would cost less than the trunk locker and little more than the locker box, but would be more durable, lighter in weight, watertight, and resistant to fungi. In addition to these advantages, it may effect a change in the tables of allowances whereby the inventory could be reduced to one item replacing three, since this locker would be suitable for both stateside use and overseas shipment.

The "Aqua-glas" preform molded locker complete with tray, gasket, and hardware weighs 22 lb., as compared to 35 lb. and 44 lb., for the locker box and locker trunk; its estimated cost per unit in large quantities is approximately $13.00. On a three-shift per day basis with one set of felting screens and dies, ap-



Outside view of locker lid before trimming. Using "Aqua-glas" preform method in molding gives more uniformly molded structure

Locker lid preforms are subjected to drying operation in continuous oven at fast cycle in order to remove all moisture from them

All photos on this and following page courtesy Hawley Products Co.

proximately 275 lockers can be produced per day. No finishing operations are required on the molded parts other than attaching a gasket and the hardware.

"Aqua-glas" preforming not only makes available a lower cost, lower density filler or extender for chopped glass rovings, but also permits rapid production of preforms which are immediately self-supporting. In addition, it can be used to produce moldings having changing radii, minimum radii of ¼ in., and wall thickness tolerances of ±0.004.

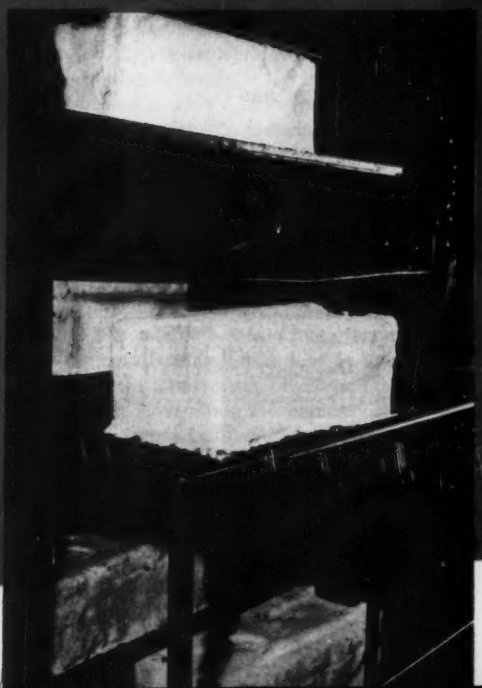
In addition to the pigments which may be added to the bonding resin, the glass and cellulose fibers may be dyed during the slurry operation; this can be carried to a point where the fiber pattern common with all moldings reinforced with fibrous glass can virtually be eliminated.

This new approach to the handling and preparation of fibrous glass for reinforced plastics moldings may well find its way in the future into such fields as boat hulls, auto bodies and parts, furniture, structural members, etc.

Table I—Test Properties of "Aqua-glas" Preform Moldings

Glass/ cellulose (dry preform)	*Thick-ness*	*Density*	*% Glass*	*% Resin*	*Flexural*	*Unnotched impact*	*3 hr. boil, % water pickup*
90/10	0.064	1.5	53.0	42	28,800 (15,600)	28.3 (17.1)	2.09
80/20	0.065	1.48	45.0	42	31,600 (14,500)	25.0 (17.7)	2.46
70/30	0.070	1.45	40.0	44	24,100 (16,900)	19.1 (22.6)	2.32
60/40	0.083	1.46	30.0	49	25,000 (17,000)	18.8 (15.4)	2.2
50/50	0.084	1.35	25.0	50	24,600 (18,700)	19.6 (17.3)	2.39
40/60	0.091	1.37	19.6	54.8	24,300 (18,100)	15.0 (12.3)	2.78
30/70	0.096	1.33	14.0	56.0	20,700 (16,800)	8.6 (12.3)	3.00
20/80	0.122	1.26	8.0	60.6	15,650 (15.000)	7.4 (8.7)	2.60
10/90	0.127	1.20	4.0	61.7	16,900 (12,600)	3.5 (7.2)	2.84
0/100	0.150	1.12	0.0	65.0	11,500 (10,350)	2.2 (4.2)	2.84
Bagasse 50/50	0.090	1.37	24.6	52	29,000 (17,700)	16.7 (15.0)	2.85

Pads were 50 grams before impregnation. All glass was 1/2" cut Fiberglas rovings. Cellulose was refined rag except where noted. Pads were oven-dried, impregnated with catalyzd Laminac PDL7-663. All moldings at 200 p.s.i. Figures in parenthesis () in flexural and unnotched impact columns represent values obtained after 3 hr. boils.

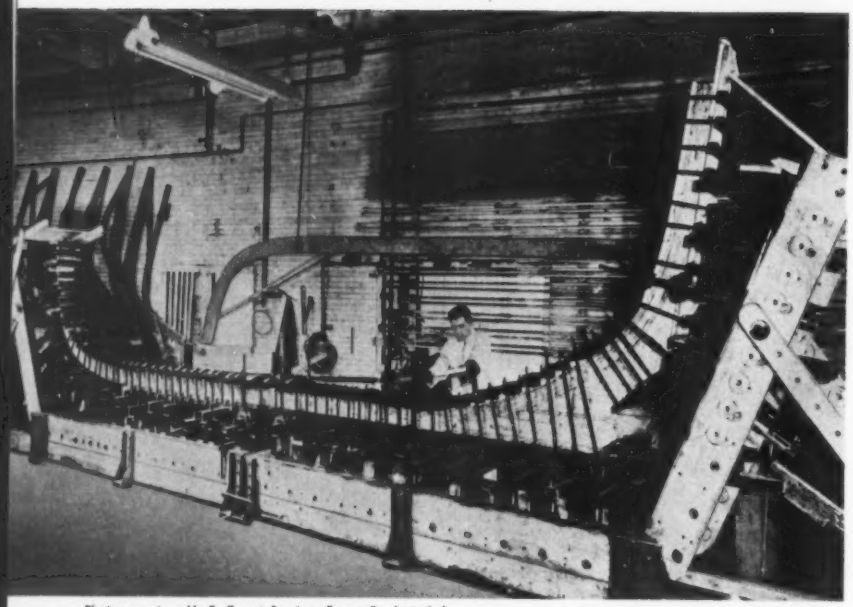


Moisture is removed from larger locker body preforms by drying in rotary, or ferris wheel type, oven.

Locker body preform, placed on metal male mold, has the resin poured on top. Pressure forces resin completely through fibers.

Molding of locker body coming out of press. Good finish and complete impregnation and coating of fibrous reinforcement is shown.

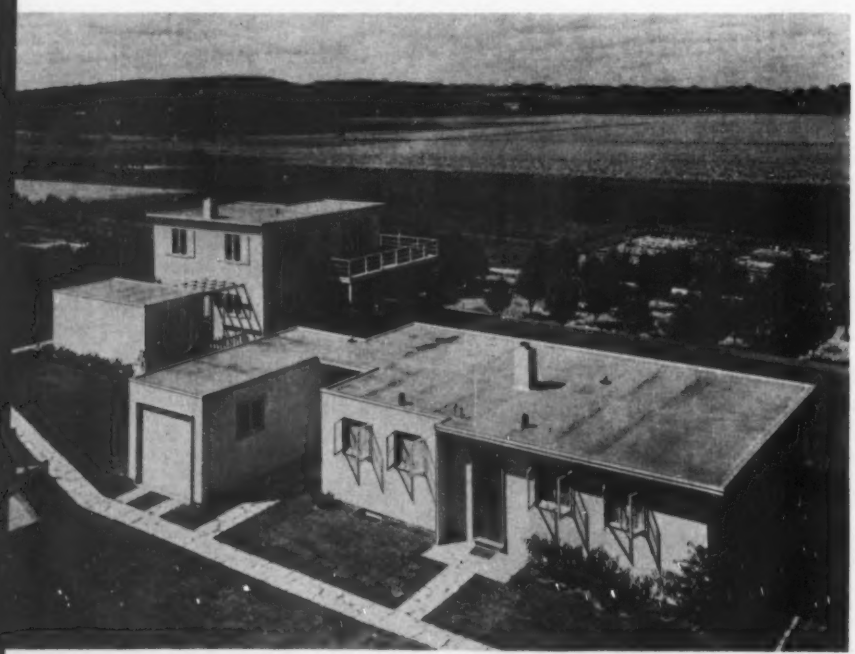
ADHESIVES



Photos courtesy U. S. Forest Service, Forest Products Lab.

Curved wooden boat keel is produced by laminating with durable synthetic resin adhesive; screw clamps hold individual plies of wood together during curing process

Prefabricated homes, constructed more than 15 years ago of wooden housing panels joined together with synthetic adhesives, are still in serviceable condition today



THE poundage of synthetic resins earmarked for the adhesives industry has enjoyed a phenomenal growth within the past ten years. In 1942, the total amount of synthetic resin adhesives produced just managed to reach 9 million pounds. This year, resin adhesives production is expected to top 245 million lb. and, according to a market survey conducted by Hercules Powder Co., production will soar to 280 million lb. in 1955.

During this period of expansion, the number of synthetic resin adhesives that have been developed, and are in various stages of development, is staggering. Since the properties and performance of a synthetic resin adhesive can be controlled to an almost infinite degree by varying its formulation, an enormous number of different adhesives—each designed to meet a specific need—are now being marketed.

To clarify this complicated situation, MODERN PLASTICS, beginning with this issue, will present a series of articles covering the use of the synthetics in the adhesion of similar materials. Since it would be impossible to cover every adhesive on the market, these articles will concern themselves primarily with trends and over-all developments in the manufacture and application of synthetic resin adhesives.

Classifications

The synthetic resin adhesives which will be discussed in this series of articles will be classified along general family lines. Within each category, however, there is a complicated range of formulations that defy any system of standardization. For the purposes of simplification, and because most of the variations within a family line exhibit similar basic characteristics, the entire range of adhesives will be treated as individual family groups.

The first division comprises the thermosetting adhesives and includes urea, melamine, phenolic, resorcinol, furane, and epoxy resins. From the

ADVANCE

toward new high volume in new markets

with new materials and new methods

standpoint of industrial use, these adhesives have proved the most popular, since they cannot be softened by solvents or heat after cure.

Members of the second division, the thermoplastic adhesives, differ from the thermosets in that they can be repeatedly softened by solvents or heat. This division includes the cellulose esters and ethers, alkyd and acrylic esters, polyamides, polystyrene, synthetic rubbers, and polyvinyl alcohol and its derivatives.

Many of today's modern adhesives, however, cannot be classified under one family group, since they often contain two different resins in a single formulation.

Properties

Before an adhesive is selected for a particular application, three factors must be taken into consideration. These are: 1) the working properties of the adhesive, i.e. the ease of preparation or use, storage or shelf life, pot life, convenience of application, amount and duration of bonding pressures and temperatures, and ease of cleaning up after use; 2) the ultimate durability of the adhesive bond, that is the degree to which the adhesive or the adhesive-bonded joint can resist such influences as moisture, heat, solvents, and stresses which tend to destroy the joint in service; and 3) the total cost involved, including not only the cost of the adhesive, but the cost of preparation, bonding equipment necessary, etc.

On all three counts, the synthetic resin adhesives have already proved themselves far superior to the vegetable and animal base adhesives.

The synthetic adhesives create bonds that are often more durable than the material itself; they are superior in water, mold, and fungus resistance; they have better light stability than the adhesives of organic origin; and, from the production and maintenance standpoint, they are cleaner and easier to use.

Today's synthetic resins are solving problems in the bonding of similar and dissimilar materials that a few years ago were thought to be impossible to resolve. Their only disadvantage seems to be the need for a longer clamping time than is required for the animal glues, a disadvantage that synthetic adhesive technologists are confident will someday be overcome.

Mass Production

Perhaps the most important property of the synthetics is their adaptability to high speed machine operations. Already the new synthetics have been responsible for many changes in mass production methods of assembly in United States industry. Thanks to the use of synthetic adhesives for bonding, consumer and industrial products are rolling off the assembly lines at an increased production rate that more than compensates for the higher cost of the synthetics.

The automotive industry, for example, is a potential large-volume market for adhesives to be used on the assembly line. Influenced by the success of synthetics in joining metal sections in the construction of airplanes, automobile manufacturers are currently considering the use of adhesives as a replacement for many costly and time-consuming mechanical bonding methods such as welding or riveting.

Other industries, such as the shoe industry, the tobacco industry, the home building industry, and the refrigerator industry, are finding increasing uses for synthetic resin adhesives. As new and better formulations are developed—particularly those with improved performance at increased or lowered temperatures—the potential market for synthetics increases.

This series of articles, which begins with the following discussion of developments in the adhesion of wood to wood, can only hint at the potential. Considering the rate of growth of the adhesives industry, today's small end users may well be tomorrow's large volume consumers.

Wood-to-Wood Bonding

by Alan A. Marra*

No. 1 of A Series

WOOD gluing has been practiced as an art for centuries. It was not until comparatively recent times, however, that the operation became one of the most important processes in the woodworking industry, particularly for veneering and laminating of wood on a volume basis.

Synthetic resin adhesives are the development that has spelled the difference. When first introduced into commercial use some 10 years ago, the synthetics opened new possibilities in the lamination of large structural members. Today, adhesives technologists—both the chemists who are formulating new synthetic adhesives as well as the engineers who are devising new equipment and processes to use them—are opening even more significant possibilities in the use of adhesives to produce more and better wooden products for modern society.

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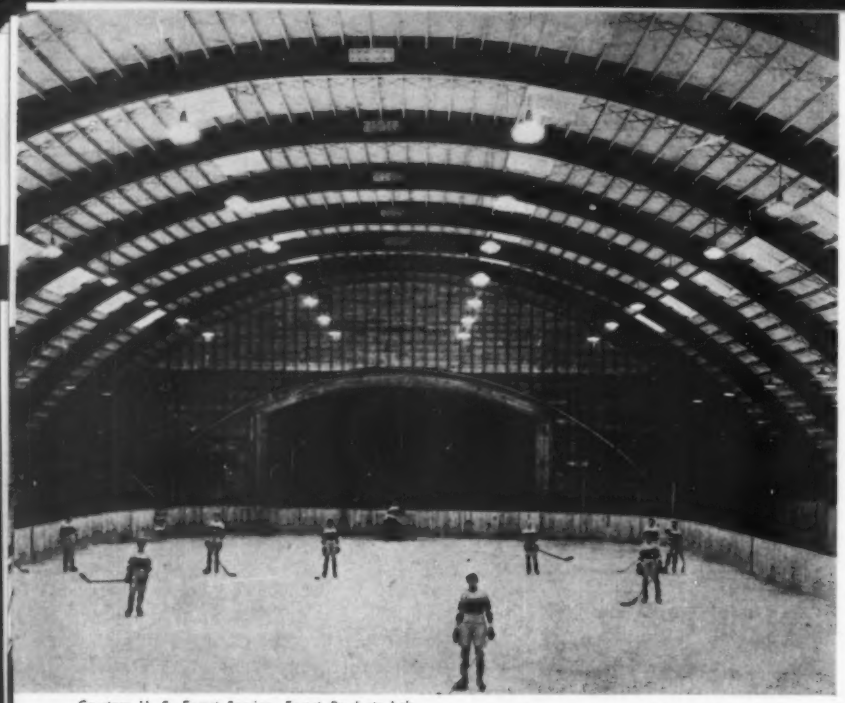
Theory of Adhesion

In comparison to the joining of such materials as metal, glass, and plastics, wood-to-wood adhesion may be considered a fairly simple process. Since wood is a porous, cellulosic material that has a great



Courtesy U. S. Forest Service, Forest Products Lab.

The lamination of wooden members as large as these curved arches for a college field house is an achievement made possible by modern adhesives and modern technology

affinity for water and other polar liquids, it presents a favorable surface for bonding with a large number of adhesives. A bond between two wood surfaces is created by applying the adhesive, usually in liquid form, to one of the surfaces. The mating surface is then brought into contact and pressure is applied until the adhesive hardens, either by losing the solvent into the wood or by polymerization with the aid of catalysts or heat.

The formulation of an adhesive to bond wood to wood, however, is far more complicated than this explanation of the theory of wood adhesion would indicate. In addition to possessing the property of hardening to a solid state, the wood adhesive must exhibit correct physical properties during cure.

These properties are strongly affected by the wood and the manner in which the gluing operation is carried on. Wood varies in porosity and in absorbency. The effects of these factors on the adhesive are in turn varied by the thickness and cut of the laminations and by the assembly and curing conditions employed. Furthermore, wood is capable of developing enormous stresses induced by moisture content changes, and the bond must hold under the most severe service exposure. Frequently, all these variations exist in the same construction and the wood adhesive must therefore have a wide tolerance to such conditions to be freely usable.

In adapting an adhesive to a particular application, the type of gluing operation that will be employed must also be taken into account. This can involve such varied factors as the manner of applying the adhesive and assembling the construction, pressure devices, means of heating, etc., all of which can affect the service performance.

Wood Adhesives

To provide a bond that would be able to perform successfully in the face of these limiting factors, the adhesives industry turned from glues of plant and animal origin to adhesives formulated from synthetic resins, from adhesives of low durability to those of extremely high durability, more permanent than the wood itself.

Of the synthetic resins that have been found suitable as wood adhesives, the most commonly used are polymers of phenol, resorcinol, melamine, urea, and polyvinyl acetate.

Phenol is the oldest of the synthetic resin adhesives and is today still the standard of durability against which all other adhesives are compared. It is used principally in the manufacture of plywood where heat can be introduced to effect the cure. Other formulations, however, are available which may be acid-catalyzed to cure at room temperatures. A major distinction from the other resins used in bonding wood is the highly alkaline nature of the phenol resin which contributes to its excellent wood-wetting properties.

Resorcinol resins are similar to phenols in color and in chemical type. Since resorcinols are much more reactive than phenol resins, they will cure at room temperatures. They are formulated and sold with a deficiency of formaldehyde in order to prolong the shelf-life. At the time of use, paraformaldehyde is added as a hardener, after which the mixture will remain usable for 3 to 4 hr., depending upon the temperature. Resorcinols are among the most expensive wood adhesives, but, when fully cured, are as durable as phenolics. Using the resorcinol adhesives, it is possible to construct massive assemblies which may be difficult to heat but which must see service under severe exposure conditions.

Melamine and urea resins both produce colorless bonds and cure with acid catalysts. Melamine resins are intermediate in cost between phenols and resorcinols and also require an intermediate temperature for curing. Bonds made with melamine resins appear to be comparable in durability with those of phenol and resorcinol.

Urea resins do not have the disadvantage of cost or color of the other resins. Furthermore, they may be cured either with or without heat, and may be used full strength or extended with flour. They are, however, not as durable as phenols, resorcinols, and melamines; they tend to weaken in high moisture and temperature.

Polyvinyl acetate resins are again different from all the rest in that they are emulsions in water and develop strength by loss of the water to the wood. They do not depend on heat or catalysts for curing, they are colorless, and they possess excellent adhesion qualities. An outstanding advantage is that they arrive in the glue room ready for use and do not need to be mixed. Rapid development of joint strength makes them favored adhesives for assembly-line work.

Three characteristics restrict the use of polyvinyl acetate adhesives. They are low in water resistance, they are low in heat resistance, and they tend to creep in those types of joints in which continuous stress is created on the bond.

Since none of the resin adhesives described individually possess all the desired characteristics of a universal wood adhesive, the natural reaction has been to combine them. One of the early successes in this direction was the combination of melamine and urea. This improves the durability of urea proportionately to the percentage of melamine added. It has been impossible, unfortunately, to reduce the curing temperature required for melamine.

Resorcinol and phenol have also been combined. In this case there is no apparent loss of the curing advantage of the resorcinol. Improvement in polyvinyl adhesives has been sought by mixing them with urea resins, thus combining the fast set of the one with the greater resistance of the other.

Urea resins have also been modified with latex and with furfuryl alcohol, the former to impart faster clamping times, and the latter to reduce the shrinkage of the curing adhesive and thus improve its gap-filling properties.

Equipment and Processes

Along with these developments in adhesive formulations, equally important developments have occurred in the equipment and process field. These were inaugurated by the hot plate press which brought the manufacture of plywood to mass production status. Others followed.

To name a few, electronic heating brought the advantages of the more durable synthetic resin adhesives to heavy constructions and reduced clamping time to a matter of seconds; bag molding in large autoclaves made possible the forming of plywood to complex shapes and resulted in such spectacular constructions as the PT boat and the Mosquito bomber; and the combination of wood and resin, under heat and high pressure, led to the development of a new material, Compreg, embodying the characteristics of both compounds.

One process which has fired the imagination of all who work with wood, is the formation of large panels from wood waste and low grade timber. The wood is reduced to chip size and subsequently pressed into panels using resin binders, chiefly urea or phenol, and high heat and temperature. By varying the temperature, the pressure, the resin, and the chip type, a wide range of properties—including density, flexural strength, dimensional stability, and texture—can be built into these boards. Already it has been estimated that the quantity of wood waste boards of all types produced in the United States, when reduced to a common thickness, now exceeds that of Douglas fir plywood.

The lamination of large curved rafter beams, and arches for the construction of barns, gymnasiums, and navy hangars, and the lamination of entire ship keels up to minesweeper size are other achievements of modern wood gluing.

Among the more recent developments is the lamination of treated timbers. Since some of the synthetic adhesives are more durable than some woods in certain service conditions, it has been found desirable to treat the wood with preservatives before the bonding operation. This successful adhesion of treated wood immeasurably broadens the frontiers of wood utilization.

The role of the synthetic resin adhesives in these developments is evident. They would not have been possible without synthetic resin adhesives possessing specific properties. For example, phenol resin for Compreg must possess different flow properties than the phenol resin used in wood waste. The ability to vary the properties of synthetic resins, and the willingness of manufacturers to create new formulations on demand, have been responsible for much of the progress in the wood industry.

Cost

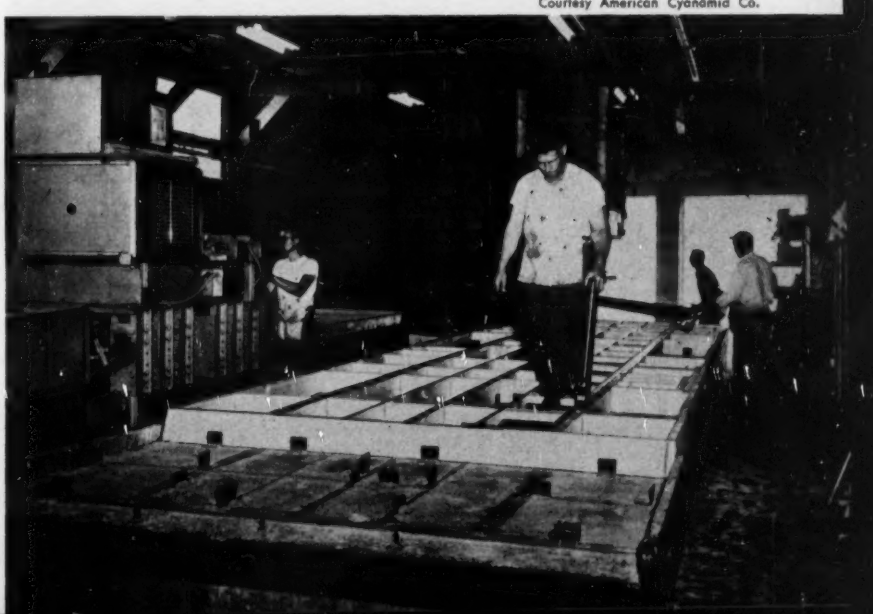
Against this background of expansion and continual development, the synthetic adhesives industry has become intensely competitive. Such a situation bodes well for the adhesives users because they are assured of continuous improvement at lowest prices.

Industry-wise, the significant changes which have occurred as a result of the manufacturers' aim at marketing a better, more inexpensive product have been largely of an adjustment or improvement nature. While no radically new adhesives have been placed on the market in volume, a high percentage of those being currently sold are improvements of earlier types.

Another important trend in the adhesives industry has been a reduction in the number of different formulations, of the same chemical type, produced by each supplier. Previously, it was considered good customer relations to have a formula exactly tailored to a particular operation. This led to the manufacture of hundreds of variously coded formulations, and inevitably caused confusion among users, as well as increased manufacturing

Urea-formaldehyde adhesive is applied by roller to beams for house trailer floor. After sheets of plywood are laid on beams, unit is cured in dielectric oven (left)

Courtesy American Cyanamid Co.



costs. These are now being replaced by a relatively few basic formulations, and specific adaptation is being done on the job with the use of an array of catalysts. The extreme versatility of urea formaldehyde adhesives, for example, is thus fully utilized. An adhesives user may carry an inventory of a single urea formaldehyde resin and, by choosing suitable catalysts, use it for hot or cold pressing, extend it with flour, or fortify it to obtain a high degree of durability.

In the interests of reducing costs to the costumer, another development in the technique of preparing the adhesive has taken place. For those users who normally add extenders to urea resin mixes, low solids content liquid resins are available. These new resins are easier and less expensive to produce, since they eliminate the costly process of adding water to the flour to obtain the proper consistency and then evaporating it perhaps under vacuum. While this means freight charges on more water, it has proved cheaper to ship water than to evaporate it. Those who benefit most from low solids solutions are the large volume users. They purchase in tank car quantities, pump it into storage tanks, and from there to the assembly line. Freight and handling costs are thus minimized.

The development of the low solids solutions has led to some debate on the actual amount of resin solids contained in the solution purchased. Consumers want to know how much resin and how much water they are paying for. One outcome of this situation has been the greater promotion of "neat" resins, that is, resins in dry powder form, without fillers or other extraneous materials, which can be completely prepared by the purchaser himself.

Standardization

The confusion that is evident in the production and use of low solids resins as well as the confusion as to exactly how much a given resin can be extended with flour and still be suitable for certain purposes, illustrate a basic need of the industry—more knowledge based on performance standards. It is possible for a solution of 45% resins solids to perform as well as one of 50% solids. Similarly, it is possible for a mixture of 75% wheat flour to perform as well as one of only 50% extension. The ratio of the major constituents is of less importance than how well they react and remain together. Hence, for a user to concentrate on the costs and contents of an adhesive is misleading. He should have a measure of performance by which to compare it.

Recognizing this need, most organizations responsible for the quality of bonded wood articles, are controlling the finished product more and more by means of performance tests. In line with this trend, The American Society for Testing Materials, through its Committee D-14 on Adhesives, is active in standardizing test methods which can be used in adhesive specifications to assure performance. The U.S. Forest Products Laboratory, Madison, Wis., is also engaged in establishing the long term durability of various adhesives.

Between the efforts of these institutions there remains a gap which must be filled before reliable interpretations can be made from the data of test methods. This gap covers the area between tests of short duration and the actual service performance of a bonded wood product. Obviously products bonded with the most durable adhesives will require years to evaluate by observation under actual service conditions. Hence, new developments of durable adhesives are at a disadvantage when it comes to proving their worth. Tests of relatively short duration which have been correlated with long term observations are needed in order to improve the measurement of adhesive value. A program designed to fill this void is under consideration by A.S.T.M. Committee D-14.

The Future

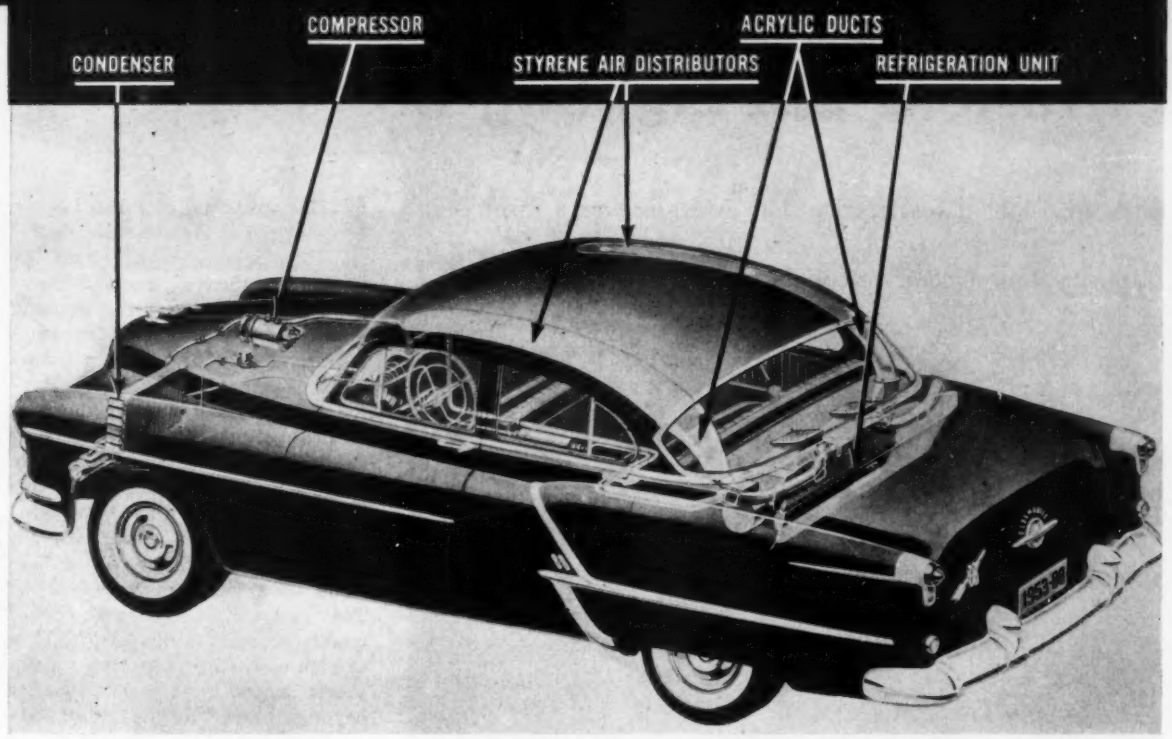
What more improvement is needed in the field of synthetic resin adhesives?

Already, it is necessary to add preservatives to the wood in order to make it last as long as the adhesives bond! In the end, it is the operator performing the actual bonding operation who must be satisfied. This man may know little about technology, but he does know that it would be nice if all he had to do to assemble a wooden unit was to trowel on some adhesive and lay the boards together. What he is asking for is an adhesive with the durability of a phenolic, the quick set of a hot animal glue, the ease of handling of a polyvinyl, the shrinkage of an epoxy, the clear color of a urea, and the cost of a soybean adhesive.

This is far from the present situation. Advance in this direction is not beyond imagination, but many of the steps to be taken are still in the realm of fundamental research. Judging by past developments, it does not seem likely that they will remain there too long.

Multiple-opening hot plate press provides sufficiently high temperatures and high pressure for the mass production of thin—but rugged—plywood sheets

Courtesy Merritt-Solem Corp.



Cutaway drawing shows location of components of an installed automobile air conditioning system. Plastics ducts serve as air distributors

Air Conditioning on the Road

Oldsmobile is one of the pioneers to offer "packaged" installations; plastics ducts distribute the air

THE summer of 1953 witnessed the first large-scale introduction of automotive air conditioning, with "packaged" installations now offered as optional equipment on several makes of cars. A look at a typical installation by Oldsmobile, one of the motor car companies pioneering this important aid to more comfortable summer driving, discloses that plastics may be expected to play an important part in this new field.

As indicated on the above-shown diagram, the principal components of the Oldsmobile Frigidaire conditioning system include a condenser and compressor located beneath the

(*Continued on p.* 210)

All photos with this article courtesy General Motors Corp.

Transparent acrylic ducts carry cool air from evaporator unit in trunk to distribution ducts running the length of the car just below the headlining

Plastics ducts are of clear acrylic (left) and high-impact polystyrene

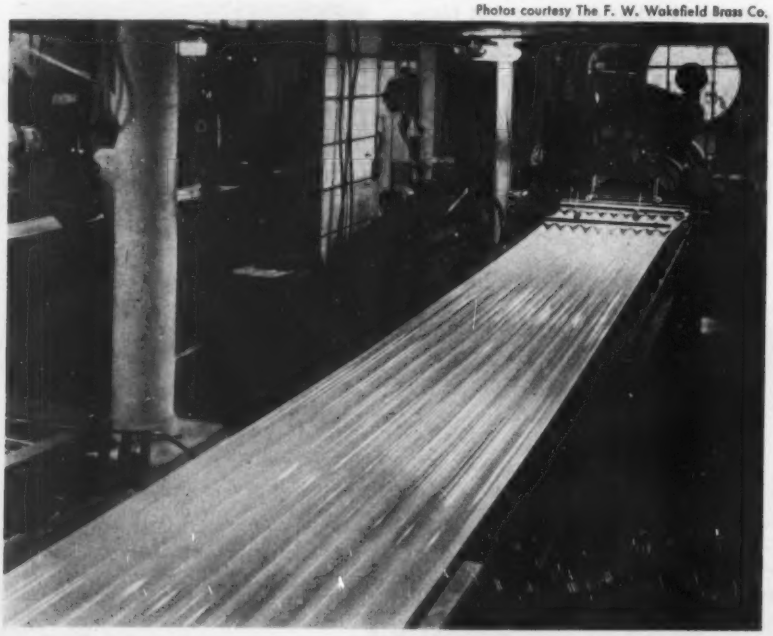
Extrusions Cut Lighting Costs

Large-area light diffusers come into wider use as a result of practical production process for corrugated acrylic sheet

Wall-to-wall light diffusers, fabricated of extruded methyl methacrylate, provide economical light efficiency for this office. Acoustical baffles reduce noise level

Acrylic material for light-diffuser ceilings is extruded continuously through corrugated die. Control of die temperature, delivery, and cooling results in uniform, stable sheet

Photos courtesy The F. W. Wakefield Brass Co.



UNTIL recently, cost has been a principal barrier in the way of wide use of broad areas of plastics as light diffusers. Such diffusers must be able to meet the exacting requirements of illuminating engineers and building codes, and continue to meet them without distortion or discoloration over the long service period which a purchaser naturally expects from a high grade lighting unit. The desire for this type of broad area diffused wall-to-wall lighting is so apparent that it is now generally referred to as "the trend toward large areas of light." The early marketing problem of quality products in this field was one of high cost. Formed or cast plastics sheets necessitated selling prices beyond the reach of the typical consumer and competitively out of line for large-area use by larger companies.

The installation in the engineering department of Douglas Aircraft, El Segundo, Calif., of about 110,000 sq. ft. of methyl methacrylate diffusers equipped with baffles for noise reduction may be regarded as marking the beginning of a new era in the use of broad areas of plastics for lighting. Back of it is the development of a practical process for the extrusion of large acrylic sheets.

The original ceiling of this type, as developed by The F. W. Wakefield Brass Co., Vermilion, Ohio, in the '40's in cooperation with authorities at M. I. T., was fabricated of formed corrugated Plexiglas.

The announcement by Wakefield earlier this year of a price reduction of 30% was made possible by improved methods of manufacture and reduced costs of the corrugated sheets through extrusion methods developed by Southern Plastics Co., Columbia, S. C. The engineers at Wakefield, which has manufactured school, office, and drafting room lighting since 1907, were most exacting in their specifications. These included: "The diffuser shall be corrugated methyl methacrylate sheets with the corrugations normal to the baffle. The diffuser shall not be less than 0.050 in. thick and shall be of a white color with a proper

(*Continued on p. 208*)

NEWS AND VIEWS OF PLASTICS PROGRESS

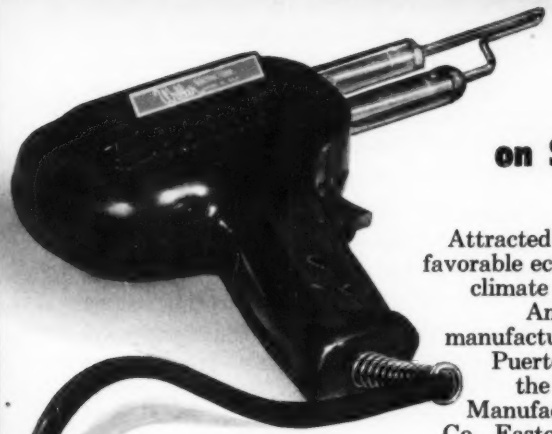
STOKES *plastics review*

VOL. 2

NO. 4

1953

PUBLISHED BY F. J. STOKES MACHINE COMPANY, PHILADELPHIA 20, PA.



Puerto Ricans Make Soldering Guns on Stokes Automatics and Semi-Automatics

Attracted by the favorable economic climate offered American manufacturers in Puerto Rico, the Weller Manufacturing Co., Easton, Pa., established a branch plant in this West Indian possession in 1950, to meet the rapidly growing demand for its handy electric soldering guns.

The Puerto Rico plant in Bayamon, San Juan, which got into production in November of 1950, operates like any other U.S. branch plant. Certain models of the Weller soldering gun—which could double as Captain Video's "atomic ray pistol"—are completely manufactured and assembled in San Juan. Shipped to the U.S., they take their place in Weller's stock alongside other models made in the Easton plant. Ninety-eight percent of these guns—from both plants—are sold in continental United States.

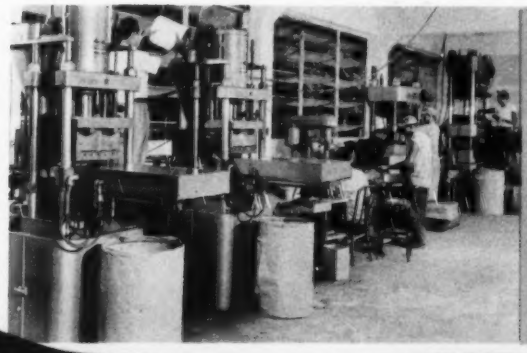
Everett C. Weller, Vice-president of the company, reports that the Puerto Rican's output compares favorably with that of his Pennsylvania co-worker—both in quality and in quantity. "These West Indians are extremely dexterous and very ingenious, and get the maximum production from their machines."

Stokes plastics molding presses—both automatic and semi-automatic types—are helping Weller in San Juan, just as they do in the Easton plant.

The main body of the soldering gun is made up of two matching halves, each molded of a nitrile-rubber-bearing phenolic compound plastic molding powder. Production, on a Stokes 200-ton semi-automatic Model 726 press, is at the rate of 90 pieces an hour. The trigger of the gun, which acts as the on-off switch, and the housing for the switch movement, are molded on two new Stokes fully automatic Model 741 50-ton presses. These parts are turned out at the rate of 240 per hour on the presses, which have recently replaced four smaller Stokes presses that had given excellent performance for more than two years.

The nickel-plated electrodes which support the copper soldering tip are cold-formed on another Stokes press—a 200-ton Model 250A. Ordinarily used for molding plastics, this press at Weller turns a 12-inch length of $\frac{5}{8}$" copper tubing into a narrow "U" and shapes the bend by coining into a suitable configuration to receive the induction windings.

"With Stokes presses," says Jose C. Rodriguez, Vice-president and General Manager of Weller's San Juan plant, "we are able to get quantity production of molded parts of high quality." This additional output coupled with larger volume at Easton enables Weller to keep up with its present demand.



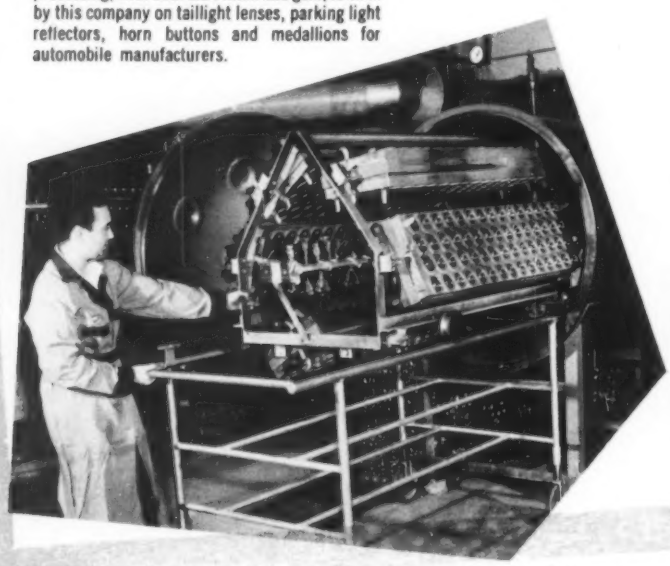
Battery of four Stokes presses at Weller Manufacturing Co., Inc., Bayamon, San Juan, Puerto Rico.

Worker removing soldering gun handles from the Stokes 200-ton Model 726 compression molding press.

Here's your 1953 Ford with vacuum- metallized taillights!

Near view of Ford taillight shows acrylic plastic cap before and after vacuum metallizing, and the assembly of cap and red plastic lens.

Operator at Detroit Plastic Molding Co. unloads Stokes Vacuum Metallizing chamber after Ford taillight caps have been metallized. 14,000 a day —700 at each loading—are processed. Similar processing, with both aluminum and gold, is done by this company on taillight lenses, parking light reflectors, horn buttons and medallions for automobile manufacturers.



Metallized Plastic Taillights Are Now Standard on Ford Cars

Plastics are finding increasing application in the automotive field. It is stated that the weight of plastic parts in the average car has approximately doubled during the last ten years, and estimated that it will redouble within the next five.

Many mechanical parts are now being made of plastics but the features which meet the eye are the external parts such as emblems, medallions, horn buttons, lenses, panel elements, etc. To many of these parts it is desired to give the appearance of metal. That's where vacuum metallizing comes in.

An example is the 1953 Ford taillight, made of red acrylic with a projecting plastic cone vacuum-metallized on the inside to give a brilliant and permanent chromium effect.

Ford taillights are processed in Stokes vacuum metallizing equipment by the Detroit Plastic Molding Co., of St. Clair Shores, Mich. 14,000 assemblies are turned out daily at the rate of 700 per load.

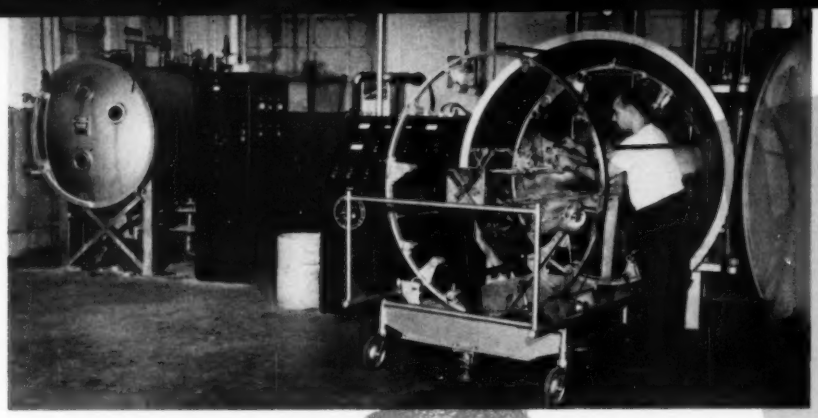
This application of vacuum metallizing substitutes for a relatively expensive metal and glass part. The unit is metallized on the inside with aluminum; then given a weatherproof protective coating of lacquer and cemented to the red lens. It is estimated that a pound of aluminum is sufficient to cover more than a quarter million taillights.

Stokes Presses Speed Production . . .

In surf-casting, the bag is a mathematical function of how many casts the fisherman makes plus how far he can throw the lure, all other factors being equal.

Ocean City Manufacturing Company of Philadelphia has a new (No. 255) Inductor Reel specially designed for surf-casting. A new level-winding device permits the line to run out through the guide without resistance. A magnetic induction device eliminates backlash. Retrieving, like casting, is smooth and deposits the line back and forth across the spool without effort on the fisherman's part. It is stated that more and longer casts are the result of this ingenious mechanism.

To meet the demand for the new Ocean City



New 72-inch Stokes Vacuum Metallizer (right) will greatly increase capacity at Jayron Corp., Leominster, Mass., where 48-inch Stokes metallizer (left) was formerly the largest unit. Jayron is one of the country's largest custom metallizers.

Vacuum metallizing gives a brilliant finish to these many different molded plastic products, ranging from sports trophies, loving cups and animal figures to religious articles and toilet accessories . . . all metallized under vacuum by Jayron Corp.

Giant Stokes Vacuum Metallizer Operates on Push-button Control

Automatic control, automatic protection, fast pump-down, and high production are features of the newest Stokes vacuum metallizer, largest ever built for industrial production. The first of these new standard units is now operating at Jayron Corporation, Leominster, Mass.

The giant chamber, 72 inches in diameter and 60 inches long, can be evacuated to ½ micron in less than seven minutes, largely by automatic operation. The operator presses No. 1 button which closes all valves to the vacuum chamber except that to the high-efficiency mechanical pump. The pump starts and quickly reduces pressure to 200 microns. No. 2 button closes the valve to the roughing line and opens three valves to the three 14-inch diffusion pumps and a smaller valve to the six-inch booster. The arrangement of the diffusion pumps—direct-connected to the vacuum chamber, without manifold—contributes to the remarkably high pump-down efficiency.

When pressure reaches ½ micron, a third automatic control permits the operator to flash the filaments and deposit the evaporated metal on the parts to be coated. After metallizing is complete the next push-button closes all valves leading to the pumps and opens another admitting air to the chamber for protection of the diffusion pumps against contamination and oxidation of oil.

Tell-tale pilot lights which inform the operator of conditions at every moment of the cycle, and Microswitch intercontrol of door and valves to insure pump operation only when door is fully closed, are other examples of automatic devices which contribute to high production and safe operation.

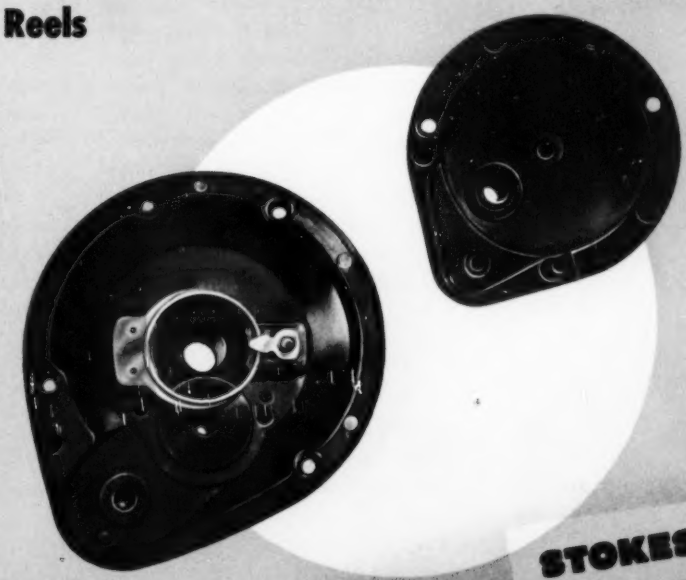
. . . on Ocean City's Level-Wind Surf Reels

No. 255 Inductor Reel it has been necessary to speed production. The side plates are now made in Ocean City's plant on four Stokes Model 741 fifty-ton fully automatic molding presses. Three more of the same presses are on order for early installation.

Four-, six-, and 12-cavity molds are used and the presses run 24 hours a day, six days a week.

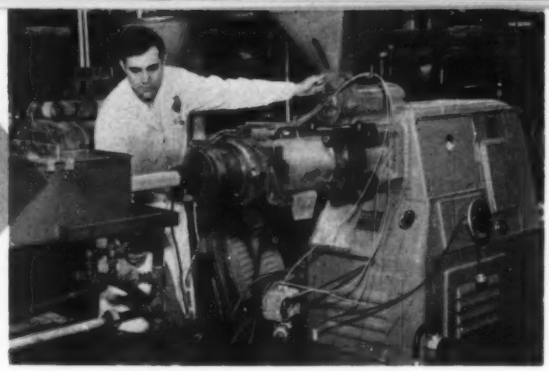
Oscar Kosma, Ocean City's tooling engineer, says: "These Stokes presses give us maximum production with minimum tooling and reduce our inventory problems. All they need is occasional attention from an operator whose sole duty is to add fresh powder to the hopper and take away the finished parts!"

Let the fish beware!



STOKES

Firestone Plastics Uses Stokes-Windsor Extruder in Rigid P.V.C. Development

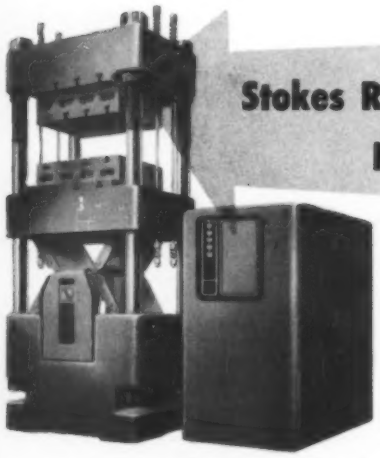


Unplasticized p.v.c. is a relatively new construction material, light in weight and highly resistant to most corrosive elements. These properties account for its growing popularity for many industrial purposes, for piping, tank linings, storage tanks, fume ducts, exhaust systems, and a variety of chemical-handling implements such as pitchers, scoops, and stirring rods.

Firestone Plastics Company, a division of the Firestone Tire & Rubber Company, at Pottstown, Pa., is one of several firms working with the new material. Firestone has developed a line of Exon resins which are specifically designed for unplasticized rigid applications and which, when compounded with efficient stabilizers and lubricants, may be processed into thermoplastic construction materials by standard fabricating processes such as calendering, laminating, molding, or extrusion.

In its laboratories at Pottstown, Firestone has installed a Stokes-Windsor RC-100 Extruder for development work. The extruder is employed for experimental blending and compounding in the development and improvement of the composition of Firestone's Exon resins and compounds, as well as in actual extrusion of test specimens of extruded p.v.c. rigid plastic pipe.

The above picture shows the Stokes-Windsor RC-100 Extruder in the Firestone Plastics laboratory, extruding 2-in. plastic pipe (I.P.S. Schedule 80) made of unplasticized p.v.c. compounded with Exon 402A resin. The plastic pipe is extruded in lengths from 10 feet to 20 feet. It is here seen passing from the extruding die into the cooling box.



Stokes Rounds Out Molding Press Line with New Improved Toggle Press

A new Stokes 150-ton semi-automatic compression press of the toggle type is now in production, superseding the earlier and widely popular Model 250-A. The new press is ideal for molding delicate insert parts and is in wide demand for making resistors, capacitors and similar items.

The exclusive Stokes Bar Controller is standard equipment on the new Model 731 as on thousands of earlier and popular Stokes toggle presses. The Bar Controller gives positive mechanical control of all press movements, is readily adjusted for completely flexible timing, and re-set in a matter of seconds to different positions for a new mold. Also; adjustment can be readily made while the press is in operation.

Re-design has provided color-coded electric connections throughout, seamless steel tubing for oil lines, dustproof control box, replaceable bushings and bearings, increased platen areas, greater distance between tie-rods to accommodate a wider range of knockout systems, and also to give greater rigidity to the machine.

Among other desirable features is a newly designed regenerative circuit which gives exceptional speed on the initial stroke. Automatic adjustable slow-down coupled with the toggle action gives varied combinations of approach and pressing speeds. A cushioned return stroke eliminates the shock common to most high-speed equipment.

The enclosed postage-free return card makes it easy to request complete information on the new Stokes Model 731 toggle press.

STOKES

F. J. STOKES MACHINE COMPANY
5534 TABOR ROAD, PHILADELPHIA 20, PA.

STOKES MAKES: High Vacuum Equipment, Vacuum Pumps and Gages/Industrial Tabletting, Powder Metal and Plastics Molding Presses/Pharmaceutical Equipment

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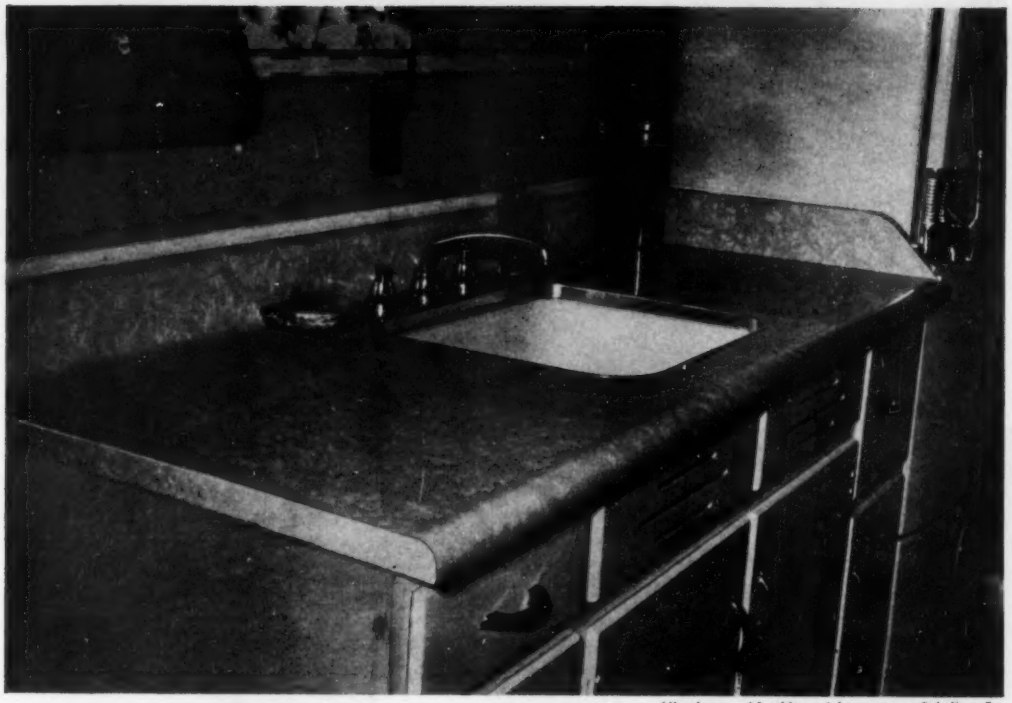


All photos with this article courtesy Bakelite Co.

One-piece sink tops made of postformed laminated sheet, such as the one shown here, represent one of the many applications of decorative postforming which are finding increased popularity

BEAUTY BENT for strength, convenience, economy

Postforming of decorative laminates is one of the most rapidly advancing fabricating techniques in the plastics industry

AN innovation in the application of decorative Formica has been brought about through the use of an old but until recently not widely used technique known as postforming. This process essentially consists of heating and bending fully cured thermosetting, laminated plastics sheet to the desired curvature. Upon cooling, the sheet will retain its new shape indefinitely. Since the pressure required for bending is very low, expensive steel dies are not necessary; hardwood or plastics dies do an excellent job. Formica sink tops formerly required separate pieces, joined with metal trim, for each angle. Cove type sink tops, made by postforming, consisting of one continuous piece of Formica, are more serviceable, more sanitary, and easier to keep clean.

At least two different methods may be used to produce finished jobs. In one method, for example, the decorative Formica is postformed and subsequently bonded to its pre-shaped plywood backing. Another method requires that the decorative sheet be bonded to its backing before being formed. Table tops are generally made by the first procedure while cove type sink tops usually are made by the second.

In both methods, the temperature to which the sheet areas to be formed are raised, and the time interval between removing the sheet from its heat source and forming, are critical factors. The optimum sheet temperature is 325° F. and the time interval should not exceed 15 seconds.

After forming, the sheet should be held in the forming fixture until its temperature has dropped to 200° F.

Figure 1 shows a forming press in the background and the special heating set-up for the Formica sheet in the foreground. With this set-up, Formica sheet not bonded to plywood, is formed. Double elements of

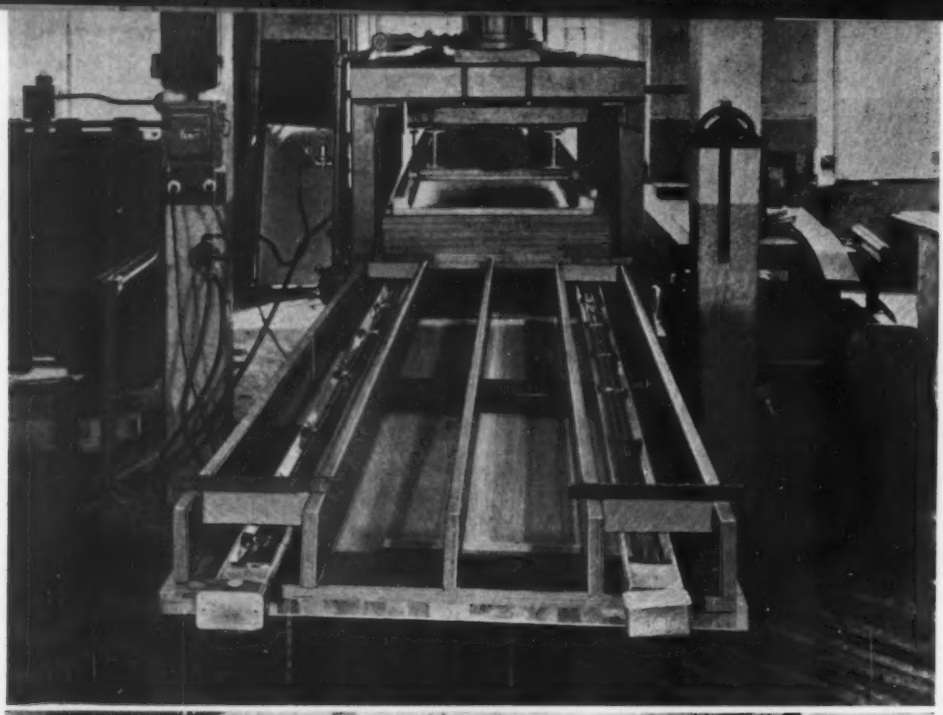


Fig. 1—Radiant heating set-up is so arranged that only those portions of the laminate which are to be formed will be heated. Laminate remains on top of heater until its temperature is raised to 325° F.

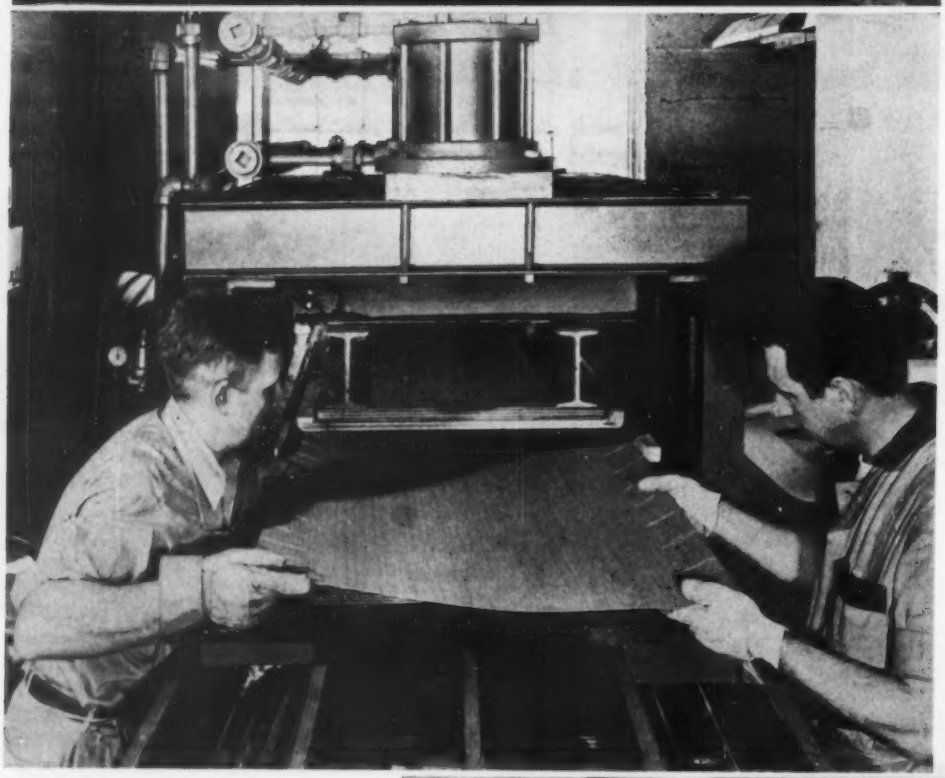


Fig. 2—After laminated sheet has been heated to a temperature of 325° F. and the appropriate areas softened, it is manually placed in female half of forming die for postforming

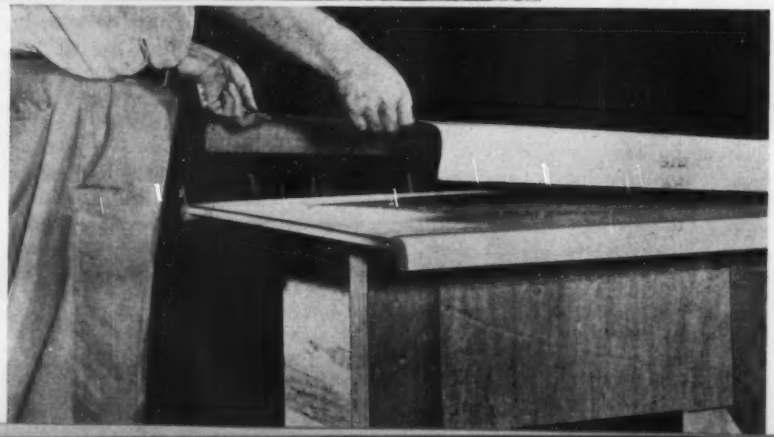


Fig. 3—Postformed sheet, after being cut to proper length, is bonded to previously shaped table top, which it now fits perfectly

Fig. 4—First step in production of cove type sink tops consists of bonding the laminated sheet to plywood by clamping the two together in a veneer press

Fig. 5—After cure of adhesive, those sections of plywood not bonded to the laminate are carefully cut out with a saw

Fig. 6—Cove block is nailed lightly in position until adhesive has cured

far infra-red heaters are located at the bottom of the two heating troughs which are at the right and left hand sides of this heating set-up. In this operation a laminated sheet is placed on top of the entire heater set-up but only those sections of the Formica to be formed are heated. After the sheet has remained on top of the heater for sufficient time to raise its temperature to 325° F., the sheet is picked up and manually placed in the female half of the forming die as shown in Fig. 2. Air cylinders on the top of the forming press force the male half of the forming die down, thus bending the sides of the laminated sheet to the required contour. After the sheet has cooled sufficiently to retain its new shape, the sheet is removed from the press.

This piece of formed laminate is cut into proper length sections so that each will serve as a decorative surface of a table top. An adhesive is applied to the Formica and, as shown in Fig. 3, the sheet is bonded to the shaped wooden table top.

Sink Tops

Producing cove type sink tops requires a more complicated procedure since, in this case, the Formica is bonded to the plywood and subsequently postformed to the required shape. In Fig. 4, a sheet of Formica and plywood with suitably applied adhesive is being placed in a veneering press where the two will be tightly clamped together until a perfect bond has been obtained.

Before the adhesive was applied to the plywood the areas beneath the Formica which are to be postformed were slightly routed out. Thus when the Formica and plywood sheets are clamped together, these areas will not be in contact and therefore, no bond will exist after the adhesive has cured. After curing, the sections of plywood which were not bonded to the laminate are carefully cut out from the back as shown in Fig. 5.

This operation requires that great care be exercised, since the saw must not cut into the thin Formica sheet.

The wood core can be made to any width and length, providing the developed dimensions do not exceed 4 by 10 ft. which is the maximum size Formica sheet available. Sink tops longer than standard sheet lengths cannot be made in one piece. They must be made as two or more separate tops which are bonded together after forming is completed. Additionally, corner tops cannot be formed in one operation but must be made by joining two pieces.

After the plywood under the section of Formica has been cut away, the Formica is placed over strip heaters until it reaches the required temperature and the postforming is carried out on a bending table which has a radius on one edge corresponding to the required finished shape of the laminate.

After postforming, the curvature is backed up with a cove block. This is applied with a urea adhesive and the cove block is lightly nailed to the two edges of the plywood as shown in Fig. 6, to hold the block in position until the adhesive has cured.

With postformed decorative laminates correctly evaluated, industrial design engineers and architects may properly and profitably suggest their uses in many new applications.

PLASTICS

Lightweight Garden Accessories

Adverse weather conditions are not considered harmful factors when lawn and garden accessories are molded of reinforced plastics. Recent application of this method as an improvement over concrete fixtures has resulted in a new line of strong, lightweight outdoor ornaments. A 9-ft. 6-in. totem pole lamp and 41-in. flamingos are just two of the many products presently manufactured.

All molding is done by the hand lay-up method employing plaster, reinforced fibrous glass, and aluminum molds. Combinations of Glidpol polyester resin and fibrous glass mat and cloth are used. Cellulose acetate and various types of waxes serve as parting agents.

The ability of reinforced plastics to resist the harmful effects of moisture, sunlight, and extreme temperature changes make its use ideal in any outdoor application.

CREDITS: *Manufactured by Tobin Enterprises, 3317 W. 23rd Pl., Cleveland, Ohio. Fibrous glass supplied by Owens-Corning Fiberglas Corp., New York, N.Y. Polyester resin by Glidden Co., Cleveland, Ohio.*

Six-In-One Phone Secretary

Essential telephone aids commonly found in two or more separate units are now available as one compact desk accessory. The chassis and all movable parts are injection molded of Lustrex LHA, with the exception of the monthly calendar made of 0.010-in. cellulose acetate sheet. The unit features a telephone index file, a phone call counter, memo pad, pencil holder, which also serves as a dialer, and perpetual monthly and yearly calendars. The combination unit can be mounted directly onto any telephone with wire bracket or inclined on a desk using an additional wire bracket inserted into base and is available in black or ivory.

The mold, mounted on an 8-oz. injection machine has 8 cavities and molds one complete phone secretary per cycle.

CREDITS: *Molded by Brill-Monfort Co., Inc., 77 Washington Ave., Brooklyn, N.Y. for Leavitt Mfg. Co., 208 E. 25th St., New York, N.Y. Polystyrene by Monsanto Chemical Co., St. Louis, Mo. Cellulose acetate by Celanese Corp. of America, New York, N.Y.*

PRODUCTS

Catch-All Bib

Novel entry in the line of baby gadgetries is the all-vinyl tray bib. The bib itself is made of 8-gage vinyl, which also extends to form the tray bottom. A 30-gage sheet of vinyl forms the tray sides and serves as a flexible tray stiffener. The sides are secured with white vinyl seam binding, which continues along all edges where it serves as a finish and also forms ties for holding the bib around the child's neck. An elastic band holds bib snugly against the child's waist.

In addition to keeping the child neat, the tray serves as a trap for all liquids and solids inadvertently upset. This is ideal equipment for any auto trip and is a labor saver in the home. The tray bib is available in blue and pink with decorative vinyl decals attached to the bib front. Each bib is individually packed in a cellophane bag.

CREDITS: *Manufactured by Greenlee Plastic Products Co., 1402 Ohio Ave., Dunbar, W. Va. Package designed by Shellmar Pdts. Corp., Mt. Vernon, Ohio.*

Snake Bite Kit

On-the-spot first aid for snake bites and injuries, an ever present danger to hunters and campers, can be satisfactorily applied with the use of these portable snake bite and first aid kits. Both kits are compactly housed in separate black two-piece injection molded boxes of cellulose acetate butyrate. The boxes feature snap fit covers that can be removed by pressing both ends of the box.

The snake bite kit consists of a tourniquet, lancet, ammonia inhalants, iodine swabs, bandages, and a vacuum suction pump equipped with large and small adapters. The opaque pump housing and transparent adapters are also injection molded of cellulose acetate butyrate to insure their ability to resist rust and corrosion. The adapters friction-fit over the housing barrel to form an air-tight joint.

CREDITS: *Boxes and parts molded by Rockford Molded Products, Inc., 2230 Kishwaukee St., Rockford, Ill. for Medical Supply Co., 1027 W. State St., Rockford, Ill. Tenite II supplied by Eastman Chemical Pdts., Inc., Kingsport, Tenn.*

Injection Speed is of special importance in production of large-area, thin molded pieces

by Paul E. Schmidt†

THE question of optimum injection speed in the injection-molding process is becoming increasingly important to both molders and machine-builders. The difficulties encountered in trying to mold thin, large-area parts especially emphasize the necessity for adequate injection speed. Parts having a thickness of 0.080 to 0.100 in. and a projected area larger than 500 sq. in. are those considered as thin, large area moldings. Figure 1 illustrates some of the current parts being molded at Panelyte which fall into this category. Thin, large framelike parts such as shown in Fig. 2 also fall into this category because of the long linear plastics flow involved.

In order to mold such large pieces, the molten polymer must flow so rapidly that the chilled layers which form at the mold surfaces do not become thick enough to choke off the flow of the hot, moving core before the mold is filled.

Speed Factors

It has been the author's experience that the best thin, large-area parts are made when the machine is operating at the highest possible injection speed. Parts made under this condition fill more easily, have a more strain-free structure, and possess greater freedom from sink marks and weld lines.

There are many factors, other than the machine volume setting, which affect the speed of injection. Hydraulic pumps fall off markedly in volume output as the pre-set line pressure is exceeded during the injection part of the cycle. Any changes which will reduce the friction of the flowing material will permit the pump to operate at a lower pressure and, therefore, at a higher volume rate. Enlarging the runners and gates will reduce fluid friction and should be carried out as far as possible without interfering with other parts of the molding cycle, such as gate seal-off. The importance of proper gate seal-off has been emphasized by Spencer and Gilmore.[1,2] The problems involved in designing molds which permit easier flow in thin, large-area moldings are a challenge to progressive molders. The simple answer to the friction problem is to make the piece thicker, but this defeats the molder's purpose of keeping costs down.

Fluid friction would be reduced if molding machines plasticized material more uniformly at higher temperatures on the short cycles permitted by thin-walled parts. This

All illustrations with this article courtesy St. Regis Paper Co.

Fig. 1—Problem of injection speed is particularly important for such parts as refrigerator inner door panel (left), upper door panel (right), and evaporator frame (foreground)

* Reg. U. S. Pat. Off.

† Development Engineer, Panelyte Div., St. Regis Paper Co., Trenton, N. J.

[1] G. D. Gilmore and R. S. Spencer, Modern Plastics, *27*, 143 (April, 1950).

[2] R. S. Spencer and G. D. Gilmore, Modern Plastics, *28*, 97 (Dec. 1950).

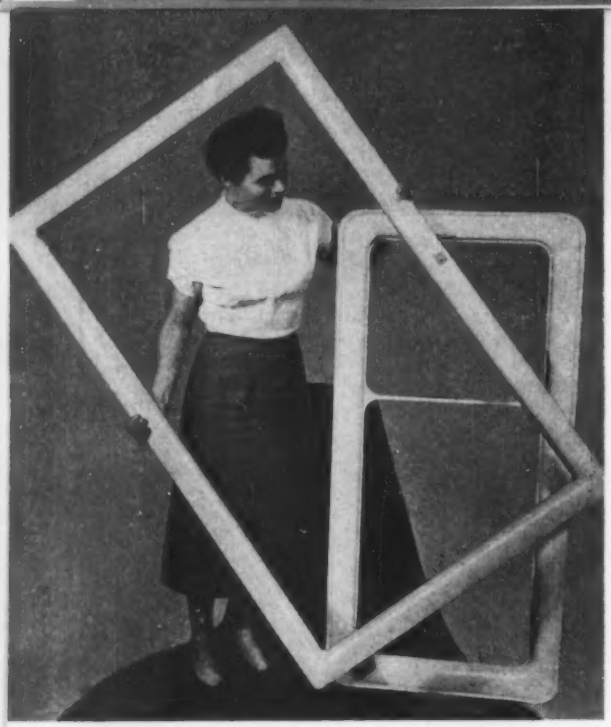


Fig. 2—Large frame is 58 by 36 in., small frame measures 55 by 26 inches. Both have 0.100-in. wall thickness. Injection speed becomes critical when molding this type of product

problem is a constant challenge to the machine builders, and while great strides have been made through the use of preplasticizing units, much improvement is still required. It has been found that the molding presses at Panelyte plasticize considerably below their rated capacity when making thin, large-area moldings.

Material manufacturers could alleviate the flow problem if they could produce easier flowing molding powders without sacrificing physical properties. Materials would also be improved if it were possible to inject them at higher temperatures without running the danger of decomposition or loss of strength.

However, recognizing the fact that all of the above improvements would allow the machine to fill a given mold more quickly, the point would soon be reached where the mold fills as fast as maximum pump output dictates. This point has already been reached under certain conditions. It is obvious that the machine then needs a larger pump or perhaps an accumulator system to actuate the plunger at a higher rate of speed. This necessitates putting more money into pressing equipment, which is already high in price. However, before such increased expenditures are authorized, the value of high rates of injection must be proved. An alert management will ask the following questions:

1) Is the improved efficiency realized from higher speeds of injection commensurate with the increased cost of equipment?

2) Is there an optimum speed of injection above which nothing further is to be gained?

3) Are there any detrimental effects caused by high injection rates?

4) Will the newly designed machines actually produce the higher injection speeds that the molder is paying for?

Before discussing the experimental work that was done at Panelyte in an attempt to answer the above questions, some background will be given pointing out why this work was undertaken.

Rate of Injection

Early experience indicated that injection speed is an important variable in producing acceptable moldings of thin, large-area parts. In many cases, parts could not be filled until steps were taken to facilitate higher rates of injection. These steps included (after pump pressure and volume controls were set at maximum) increasing die temperatures, opening runners and gates, increasing material temperatures, and, as a final resort, lengthening the cycle to obtain more thoroughly plasticized material. Weigh-feeding devices have aided greatly in maintaining high speeds of injection by preventing choking of the heating cylinder and thus eliminating this source of excess pressure drop. It was found that injection speed was so critical that when certain parts were running satisfactorily, any variable that was changed which increased the fill time by as little as 5% resulted in a scrap piece.

Actually, for many moldings one could predict whether a given piece would be good or scrap merely by observing whether the speed of injection fell within predetermined values.

Lower Pump Volume

After a mold has been running on a satisfactory cycle and the speed of injection is decreased by reducing the pump volume output, the first defects to be noted are sink marks at the perimeter of the piece. A further decrease results in a thickness reduction and an unfilled piece. In some cases, where slow speed of injection is used, a peculiar flow phenomenon can be observed. The hot material chills and becomes more viscous, and flow momentarily slows down or stops. Then, as the pressure builds up, the mold opens slightly. This opening permits the incoming hotter plastic to "break out" and flow past the colder material. This broken or interrupted flow produces several well-defined defects:

1) A ragged plastic flow, which produces many poor weld lines and sometimes trapped air marks. (Flow patterns are very markedly changed when the speed of injection is reduced.)

2) The appearance of very large depressed areas resembling huge sink marks on the part. These depressed areas represent the thickness of the part before the clamp ram is backed off and the hotter plastic "breaks out."

These two defects are illustrated in Fig. 3. The panel shows the large depressed areas and a rather uneven flow of plastic resulting from the reduced injection speed. Time for injection of this shot was 17.5 seconds. Four gates were used in this mold to obtain sufficient injection speed to make a panel this large in the thickness required. These gates were each located at the intersection of three ribs. This panel measures

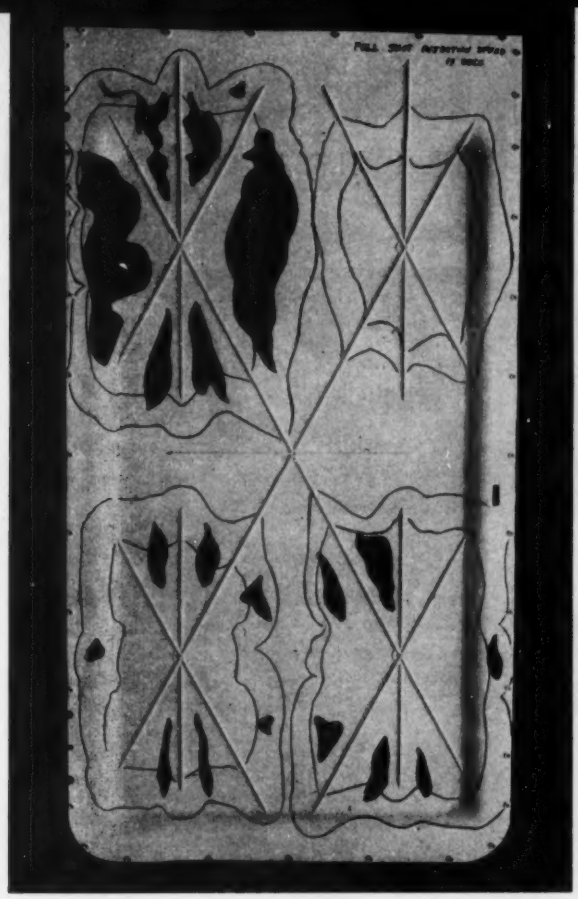


Fig. 3—With injection speed at 17.5 sec. per shot, plastic flow is ragged and sink mark-like areas (in color) appear on the part

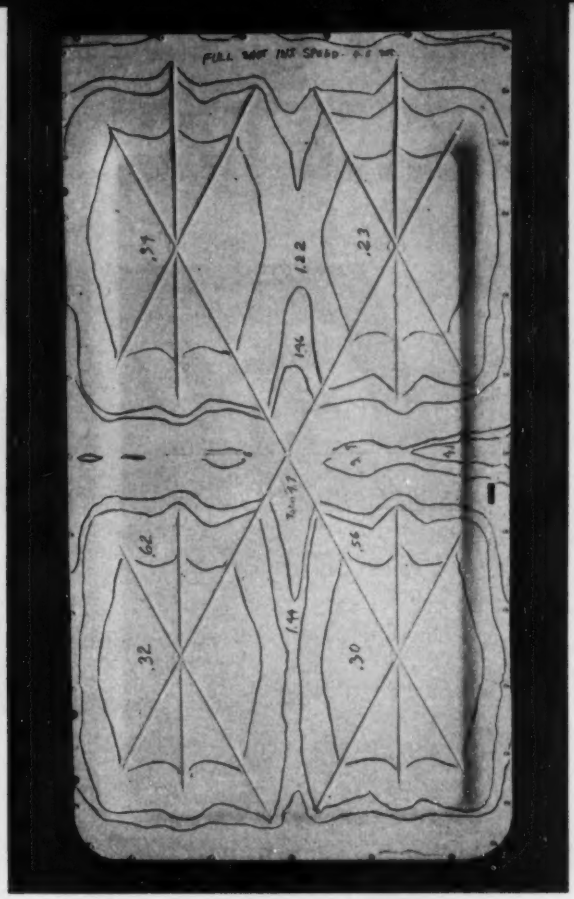


Fig. 4—Same panel, molded at full injection speed of 4.5 sec. per shot, exhibits no sink marks. Results of short shots are drawn in

1500 sq. in. in area and averages 0.085 in. thick. The panel in Fig. 4 was made at full injection speed, 4.5 seconds. The part was completely filled out. However, previous experimental short shots had been made in which the part did not completely fill out. The areas of these short shots are illustrated by the lines drawn on the part. The lines illustrate four short shots each successively closer to being filled out completely. The numerals shown for each of these short shots represent the total weight in pounds of each section of the shot.

Increased Strain

Reduced injection speed also produces increased strains, which can be readily observed in clear parts. These strains are due to increased frozen orientation (described by Spencer and Gilmore, see reference 2, above) because the plastic flows for a longer time while it is being cooled. The part in Fig. 5, as observed through crossed Polaroids, is less strained than the part in Fig. 6. The latter was made on the same cycle used for the former except that only one-half the injection rate was used in this case.

It is important to note that every mold at Panelyte is run at the fastest possible injection speed, and it has been adequately proved that higher quality parts are made by this technique. The only detrimental effect noted to date from using fast rates is the increased tendency toward air entrapment, which is easily corrected by proper mold venting.

The questions which naturally arose after making the above observations were:

1) What would be the effect on large-area moldings if higher rates

(*Continued on p. 124*)

Fig. 5—Crossed Polaroids reveal only minor strains in part molded at high injection speed

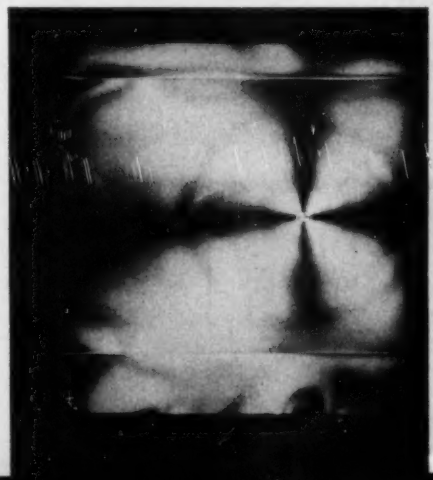
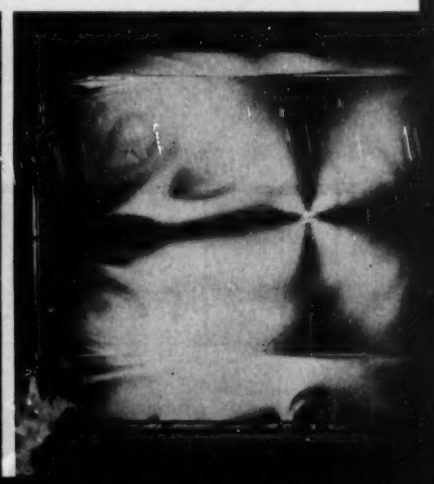
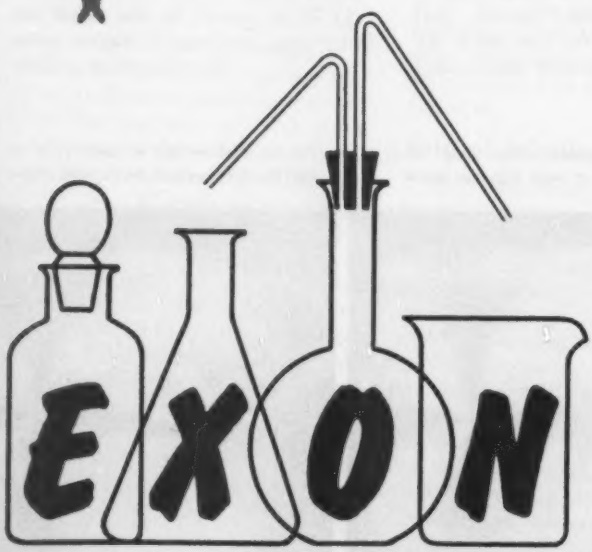


Fig. 6—Part molded on same cycle at half the injection rate shows more strain



now...a fine, new plastisol resin

EXON 654



PHYSICAL PROPERTIES OF *EXON* 654

Readily dispersed in plasticizer by simple stirring—no grinding necessary.

Form	Fine White Powder
Specific Gravity	1.40
Average Relative Viscosity	2.65

For complete information on Exon 654 or any other resin in the extensive Firestone Exon line, write or phone... Chemical Sales Division, Firestone Plastics Co., Dept. 18 B, Pottstown, Pa.

joins the Firestone EXON line!

Yes, Firestone is proud to announce another addition to its ever-growing line of high standard EXON resins . . . EXON 654.

The latest result of Firestone's unceasing attempts to bring you the perfect resin for your particular application, EXON 654 is a stir-in-type plastisol resin that is expressly created to impart excellent heat and light stability, physical toughness and chemical stability to your final products.

If your application calls for casting thin films, coating paper . . . fabrics . . . other dip coating or slush molding operations, why not assure yourself of a top-grade product by specifying EXON 654.

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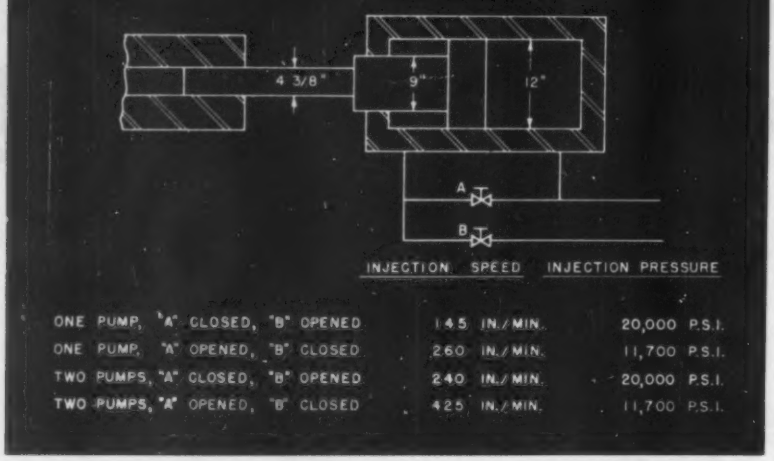


	INJECTION SPEED	INJECTION PRESSURE
ONE PUMP, "A" CLOSED, "B" OPENED	145 IN./MIN.	20,000 P.S.I.
ONE PUMP, "A" OPENED, "B" CLOSED	260 IN./MIN.	11,700 P.S.I.
TWO PUMPS, "A" CLOSED, "B" OPENED	240 IN./MIN.	20,000 P.S.I.
TWO PUMPS, "A" OPENED, "B" CLOSED	425 IN./MIN.	11,700 P.S.I.

Fig. 7—Schematic diagram of experimental injection cylinder for production of parts similar to refrigerator inner door panels. Valving arrangement allows speed variation

of injection than those presently used could be obtained?

2) Would it be possible to determine an optimum rate of injection above which nothing is gained or detrimental effects start to appear?

3) What should be requested from manufacturers of new and larger presses, from the standpoint of injection rates and injection pressures as well as the other more easily determined specifications?

Experimental Work

In order to answer these questions, an extensive experimental program was undertaken. For this work, a center-gated mold was built to produce a part similar to a refrigerator inner door panel. The full piece size was 30 by 42 by 0.085 in. thick. This mold was placed in a 120-oz. Watson-Stillman, equipped with a preplasticizer and a 1500-ton clamp. This press has a 75-hp. motor, driving a 71.4-gal./min. pump at 2750 p.s.i. to actuate the injection system. The schematic diagram of the injection cylinder of this machine is shown in Fig. 7. Also shown in this figure is a valving arrangement that was used in these experiments so that oil could be diverted from the front to the rear of the hydraulic piston to obtain a gain in speed, but with a sacrifice in pressure.

In order to obtain injection speeds higher than would be possible with the above pump, the pump output of an adjacent press was connected to the hydraulic system of the test press. This extra pump delivered 45 gal. per min. at 2750 p.s.i. and was driven by a 50-hp. motor.

Most of the desired data could be obtained without too much difficulty, either during or after the molding cycle. However, the conventional machine gages provide insufficient information to show accurately the trend of injection pressure during the injection stroke. In order to obtain pressure-volume diagrams for the various experimental moldings produced, a hydraulic indicator was attached to the injection circuit of the test press. These resultant pressure-volume diagrams provided a permanent record of the injection pressure required for each shot and were useful in determining the work done on the plastic during the injection stroke. The drum of the indicator was connected through a reducing mechanism to the injection plunger. The spring and piston system of the indicator was such that 1 in. on the pressure scale of the indicator card equaled 2000 p.s.i.

The press was adjusted to an operating cycle with the preplasticizing and shooting cylinder pyrometers set at 480° F.; the actual mold temperature, measured at the mold surface, was 170° F. Dow 475 high impact polystyrene was used for this experiment. Feed was maintained as constant as possible. This press was not equipped with a weigh-feeding device.

Volume Variation

The overall cycle was kept constant at 180 seconds. During the run, the volume of the first pump was varied from low to maximum output. After maximum injection speed was reached with the single pump, the second pump was added to the circuit. Each piece was weighed and the thickness measured. The length of the injection stroke and the time for injection were recorded. An indicator card was made for each molding.

The data of this experimental work are tabulated in the form of plotted curves. It should be borne in mind that the quantitative values plotted on the curves have meaning only for the given mold in the given press and under the given running conditions. However, the trends indicated by these curves are valuable in a qualitative sense.

Flow Length

Two curves which are not presented here will be briefly discussed. On the first curve, the ratio of maximum length of flow to the thickness of the piece was plotted vs. injection rate. It indicates that ratio is directly proportional to the rate of injection within the limits of the experiment. This emphasizes the value of high rates of injection, because with higher speed, a larger piece can be made without a corresponding increase in the thickness. On the other hand, a part of given size could be made with a reduction in thickness.

The projected area of the part as ordinates vs. injection rate as abscissae was plotted on the second curve. This curve rises rapidly at first and then tapers off to a straight line of lesser slope. An interesting point of this curve is that, for this particular mold, the knee of the curve falls at a rate of 0.5 lb. per second. Below this rate, the unfilled piece shows uneven, broken-out flow at the plastic front. Above this rate, the plastic exhibits a smooth front.

In all the curves reproduced in this article, the variables are plotted versus the injection rate in lb. per sec. rather than in in. per minutes. The reason for this choice is that lb. per sec. is independent of machine dimensions while this is not true of in. per min.; therefore, comparisons between different machines are more easily made.

Figure 8 shows the relationship between the machine oil pressure in the injection system during the injection stroke and the injection rate. It will be noted that the mean effective machine pressure is plotted, rather than the maximum machine pressure. The reason for this choice is that the error in locating and then

scaling the maximum machine pressure on the indicator cards causes considerable scatter of the points. The mean effective machine pressure is obtained by dividing the area of the indicator diagram by the length of injection stroke. It was found that the maximum pressure averaged 25% higher than the mean pressure. The maximum pressure required for injection at any given rate would therefore follow the values of the broken curve.

A possible explanation for the shape of this curve is given as follows. Fluid flow theory shows that the pressure drop in a flowing fluid is roughly proportional to the square of the rate of flow. This is particularly true in the region of turbulent flow. The pressure drop is also inversely proportional to the thickness of the confining channel. In the case of flowing plastic, the thickness of the hot flowing core increases with increase in velocity because the chilled layers at the walls of the mold become thinner. This thinning effect is more pronounced at higher rates of flow because of the higher shear forces involved. This accounts for the initial, rapid rise of the curve with the subsequent flattening out. Finally, at a sufficiently high rate of flow, the chilled layer cannot become appreciably thinner and the thickness of the moving layer is controlled by the mold thickness. From this point on, the curve should follow a rough parabola determined by the square of the velocity alone.

The obvious fact brought out by this curve is that higher pressures are required for higher injection rates. Increased pressure on the material can be obtained by increasing line pressure or by changing the piston and plunger diameters. It is apparent that machine manufacturers should consider this point in their proposed specifications for large machines.

Design Proposals

Some proposed machines have been designed to inject over 5 lb. of plastic per sec. with hydraulic line pressures in the range of 3000 p.s.i. and a hydraulic piston-to-injection plunger area ratio which will give 20,000 p.s.i. pressure on the material. These pressures are essentially the same as those produced by the test press. As Fig. 8 shows, such speeds would not be possible with this low line pressure in a press of present design equipped with a mold similar to those in normal use today. Therefore, the molder would be paying for large volume pumps which would go off stroke long before the maximum speed of injection is reached.

The lower two circled points in Fig. 8 represent the mean effective pressure when the valves were changed so that the hydraulic fluid effectively acted on a piston of lesser area. In other words, Valve A (Fig. 7) was opened and Valve B was closed. This results in a reduction of the hydraulic piston-to-plunger area ratio. It can be noted that these points fall quite far above the plotted curve. The upper two circled points represent the maximum pressure under the same conditions. These fall very far above the maximum pressure curve because, for these conditions, the maximum pressure was 60% greater than the mean pressure. The fact that such high pressures were necessary for the limited speeds obtained emphasizes the importance of proper piston-to-plunger ratios to effect the most efficient transferral of available line pressure to maximum possible injection rate in lb. per second.

In order to explore further the question of optimum piston-to-plunger ratios, Fig. 9 is presented. In this curve, actual pressure on the material is plotted vs. the injection rate and is labeled "mold pressure curve." This curve is based on the data presented in Fig. 8. A second curve, "machine pressure curve," is also plotted and is based on the machine dimensions. It can be shown that for any press

$$\text{Inj. speed, lb./sec.} = \frac{k}{\text{Inj. pressure, p.s.i.}}$$

where

$$k = \frac{(\text{LP, p.s.i.})\ (\text{PO, gal./min.})\ (x)}{(\text{sp. vol., cu. in./lb.})\ (y)} = 26{,}000 \text{ for the test press}$$

where LP=line pressure, PO=pump output, x=231 cu. in. per gal., and y=60 sec. per minute.

Operating Points

Thus, a curve of injection pressure vs. injection rate based on the machine dimensions is a hyperbola, each point of which represents one specific piston-to-plunger ratio. With the valves changed to give high speed at low pressure, the press

(*Continued on p. 128*)

Fig. 8—Relationship between machine oil pressure and the injection rate. Maximum pressure average is about 25% above mean pressure

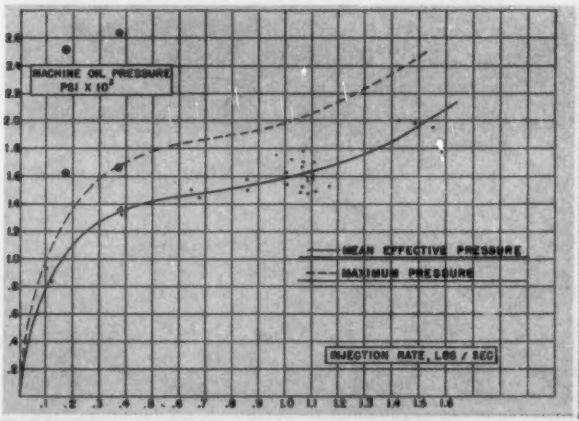
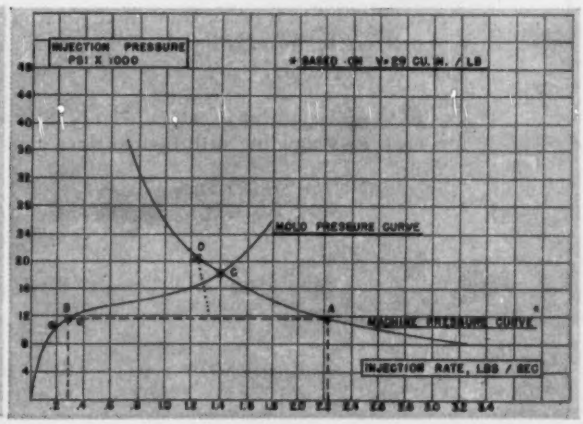


Fig. 9—Intersection of machine pressure curve and mold pressure curve is point of theoretical optimum piston-to-plunger ratio



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A number of technical service bulletins are available for more detailed information on the Styron formulations. For details, write THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales PL 1383.

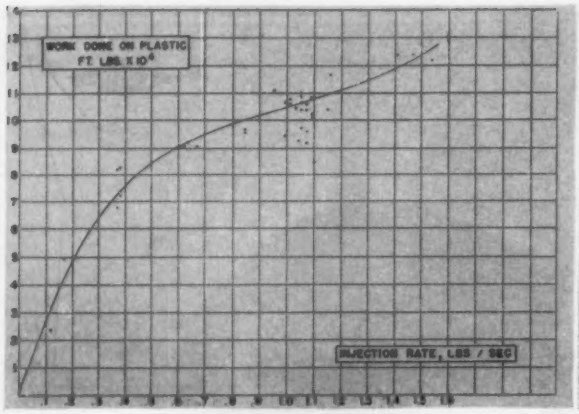


Fig. 10—Graph of work done by oil on plastic versus injection rate. From this graph horsepower consumption of plastic can be calculated

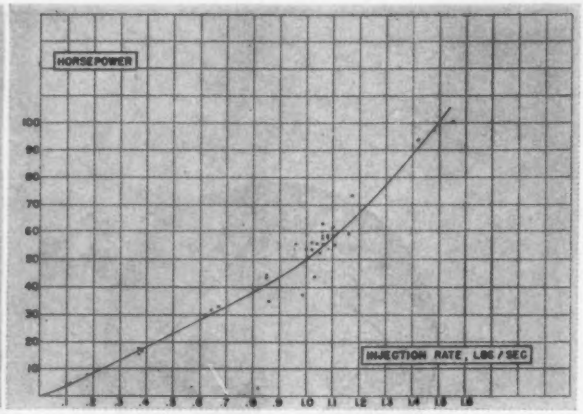


Fig. 11—Graph of horsepower consumption versus injection rate indicates prohibitive power requirements in the 5-lb. per sec. range

should operate at Point A on the hyperbola and inject at a rate of 2.24 lb. per second. However, the pressure produced by the press at this point is much lower than that required by the "mold pressure curve."

Optimum Ratio

Therefore, the pump must go off stroke and reduce its volume output at constant pressure until the "mold pressure curve" is reached at Point B. Then the mold should fill at a rate of 0.28 lb. per second. This is confirmed within the limit of experimental error by the two circled points, which represent the actual conditions with the valves changed. It is obvious that the theoretically optimum piston-to-plunger ratio for the operation of this mold at the highest possible rate is at the intersection of the two curves, or Point C.

Any point higher on the hyperbola than Point C represents a piston-to-plunger ratio which sacrifices injection speed for unnecessarily high pressure. Such a point is D, which represents the actual press specifications. If the press is operating at some Point D above the mold pressure curve, a slight gain in speed will be observed as the line pressure drops to the pressure required by the mold. This added speed is dependent on the characteristics of pump and is represented by the dotted line. It can be seen, however, that this increase in speed is small.

In the design of large presses, the hyperbola will be shifted upwards and to the right if either line pressure or pump volume or both are increased. Since the two pressure curves will then intersect at a point of higher pressure, it will be necessary to increase the piston-to-plunger ratio if volume alone is increased and line pressure is kept constant. Changing line pressure may or may not necessitate a change in the piston-to-plunger ratio. However, it is obvious that a press cannot meet design specifications if pump volume is increased while line pressure and the piston-to-plunger ratio are kept constant. Further work along the above lines should be done with other molds to determine the average optimum piston-to-plunger ratio suitable for all molds which will run in a given press. Perhaps a theoretical approach can be developed for predicting the mold pressure curves for non-existent molds which will run in new, large presses.

Plasticization

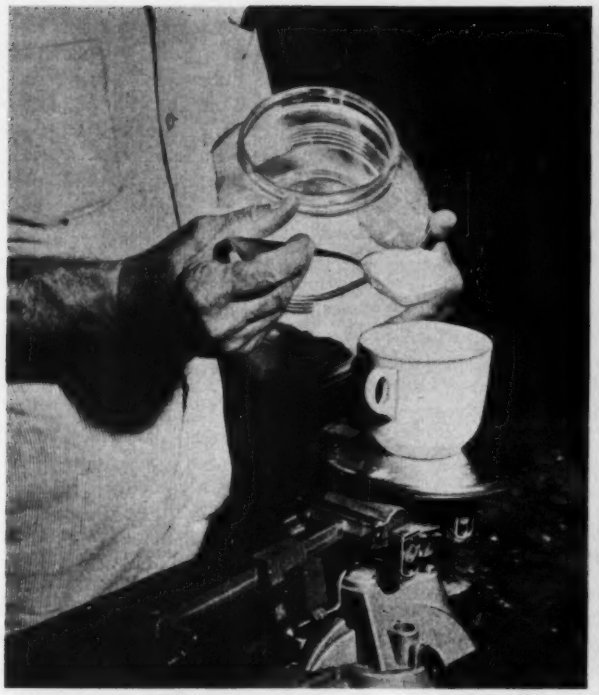
The work done by the oil on the plastic versus the injection rate is plotted in Fig. 10. These data were obtained from the area of indicator cards.

From this data source, the horsepower consumed by the plastic for the various rates of injection was calculated and plotted in Fig. 11. This curve indicates that the power requirements for rates of injection in the proposed 5-lb. per sec. range will be prohibitively high unless much better plasticization is obtained.

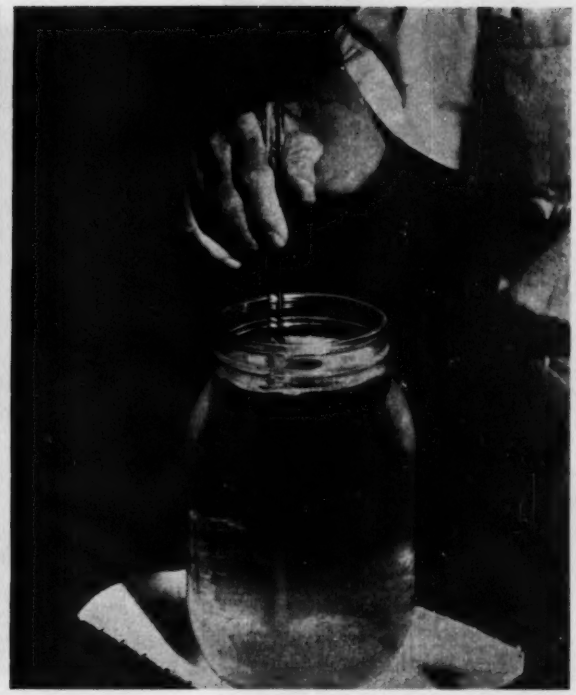
Consequently, thought should be given to the use of accumulators in the injection system which would require less power because of the longer time interval permitted during charging. This transition should not be too difficult since accumulators are presently used in die-casting machines. However, accumulators of the type which would be used on self-contained equipment are not the final answer and neither are the presently used pumps. Accumulators of this type fall off in volume output with time, and the pumps at best maintain constant output when operating at pressures below the set pressure. Actually what is needed is a source of increasing volume during the injection stroke. This will prevent the plastic front from slowing down as the radial distance from the sprue to the front is increased as the piece fills.

Summary

To summarize, high rates of injection are a definite requirement for producing thin, large-area moldings. How high to go is still an unanswered question. No optimum rate was found in the above work. Neither was any detrimental effect noted in the molded pieces. However, the above beginning indicates that much more work is necessary to evaluate fully high rates of injection. Also, more data are needed so that intelligent specifications can be written for large machines. At Panelyte, the constant aim is to improve mold design so that the maximum speed can be obtained from the present machines. To date, our best molds allow the presses to inject as fast as the maximum pump output dictates.



Solid sodium hydroxide is carefully weighed as the first step in preparing a solution for the removal of the inhibitor from the monomer



Following the addition of the sodium hydroxide solution to the monomer, the mixture must be agitated continuously for ten minutes

Embedding in Acrylics

Complete details on the process, from preparation of materials to be embedded to machining the finished casting

by A. J. Spilner*

A WIDE variety of specimens can be embedded in acrylic resins, provided that they can be dried and that the dried specimens do not inhibit polymerization of the monomer, are not attacked by the monomer, and can withstand normal polymerization temperatures and pressures.

Small portions of specimens should be tested in the monomer to be sure that the specimen does not disintegrate and that dyes or pigments in the specimens will not bleed out and spoil the appearance.

Metal specimens present special problems because they contract much less than the cured polymer in cooling from polymerization temperature to room temperature. This thermal contraction differential often results in cracking of the polymer. In addition, the polymer tends to part from the surface of the metal specimen, the void space giving a "silvered" appearance in that area. Primarily for this reason, the maximum size of metal specimens which can be successfully embedded is quite limited.

Adhesion to metal can be improved by sandblasting or otherwise roughening the surfaces of the specimen. Another approach to this problem is to use a monomer or combination of monomers which will cure to a softer polymer.

Copper, and metals containing copper, act as inhibitors and prevent proper polymerization of acrylic monomers. Specimens made of or containing copper must therefore be coated to prevent actual contact between the copper and the monomer. Coatings of cellulose acetate, clear enamel, sodium silicate ("waterglass") and polyvinyl alcohol, among others, may be helpful. Other metals should be tested if there is any question of possible inhibiting effects.

It is always desirable to embed a sample specimen to determine the above effects and the best curing conditions for specific types.

Drying

Specimens to be embedded in acrylic resins should be dry. While it may be possible to embed some

* Plastics Dept., Rohm & Haas Co.

Inhibitor-free monomer is poured and filtered, inhibitor remains in jar

Polymer powder is added to inhibitor-free monomer to form casting slurry

types of moist specimens, (1, 2)† the moisture will tend to cause cloudiness in the finished embedment. Most inorganic specimens and some organic specimens can be over-dried without distortion. On the other hand, vegetable and biological specimens tend to lose their shape and color if air-oven dried, but may be freeze-dried if they can withstand freezing without harm. By using the freeze-drying method, portions of human or animal organs or whole organs and some types of vegetable specimens can be prepared for embedment without distortion and with good retention of original color.

The freeze drying technique (3, 4, 5, 6) has been found useful in the preparation of pathological specimens where it is difficult to preserve both shape and color by other drying methods.

Prior to freezing, the fresh specimen should be trimmed and all excess fat removed.

Freezing Techniques

Two different techniques are used for freezing, depending on the thickness of the specimen. For specimens up to about ½ in. thick, the following procedure is suggested:

Place the specimen, thoroughly wet, on a thin base of ice and freeze it by placing in a low temperature cabinet (−5 to −15° F.). Instantaneous freezing does not improve the specimen, and slow freezing should also be avoided. When the specimen is frozen, add ice water and freeze successive layers of water until the specimen is completely covered with about ¼ in. thickness of ice.

For larger specimens, such as a human heart, for example, the procedure is as follows: Place the organ, thoroughly wet, on a thin base of ice and allow it to freeze. When the specimen is thoroughly frozen and fixed to the base, spray it with water several times, using an atomizer, to glaze it thoroughly with a thin layer of ice. A layer of 0.05 to 0.10 in. in thickness is enough to protect the surface of the specimen from drying and subsequent shrinkage or loss of color. The specimen is then completely embedded in ice by freezing sucessive layers of ice water. Avoid pouring water on the specimen itself, because this will melt the glaze of ice.

Before placing the block of ice in the drying apparatus, chip off as much excess ice as possible to reduce drying time. The ice blocks must be thoroughly chilled to −15° F. or lower before they are transferred to the drying apparatus.

The drying apparatus must be capable of maintaining a temperature of 0 to 10° F. in the specimen itself, while the water is being removed by sublimation. The apparatus described in reference 4 will remove up to 15 liters of water at one time. The water jacket heating the drying chamber should be maintained at a temperature of 100 to 105° F. Higher temperatures may be injurious to pathological specimens containing large quantities of fat.

The blocks of ice containing the specimens to be dried should be held in a loosely tied bag made of a single layer of 12-mesh gauze. The wrapped specimen should be placed in wire baskets or on mesh wire supports and so arranged as to allow a free flow of the water vapor. Medium sized specimens (approximately 2 to 3 in. in thickness but of any width which will fit the drying chamber) may be completely dried in the above apparatus in five to seven days. Very large organs, such as an entire brain, may require up to 15 days for complete drying.

This method, when properly carried out, causes no distortion of the specimen as the result of drying except in cases where air may be trapped within the specimen, in which case some contraction may be observed.

Trimming Specimens

Once the specimen is dried, it should be maintained by placing it carefully in a glass desiccator containing a suitable dehydrating agent such as anhydrous calcium sulfate.* Before embedding, specimens may be kept in the dried state for several weeks or even months without deterioration. For best results, however, a dried specimen should be embedded as soon as convenient. The specimen can now be trimmed with a very sharp knife to remove all loose portions and to improve the appearance. A very smooth trimmed surface generally allows a much better view of the intimate structure of the specimen.

Selection of the Monomer

Methyl methacrylate and ethyl methacrylate monomers form relatively hard polymers and should be used for embedding specimens which are for display purposes. Although higher priced, ethyl methacrylate

† Numbers in parentheses link to references on page 136.

* Supplied by W. A. Hammond Drierite Co., Xenia, Ohio, under the name Drierite.

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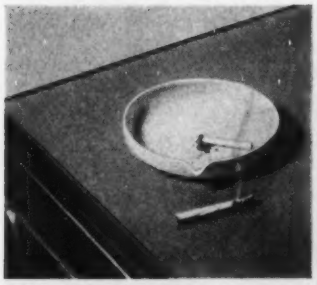

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has a higher boiling point than methyl methacrylate and is therefore somewhat less subject to bubbling during cure.

Butyl methacrylate monomer forms a permanently soft polymer which is easily cut. It is preferred for embedding specimens which are to be sliced into thin sections.

If methyl and ethyl methacrylate polymers are too hard and butyl methacrylate polymer too soft for the purpose intended, mixtures of these monomers can be polymerized to obtain almost any intermediate degree of hardness. When softer polymers are required, this method will generally give better results than using plasticizers to soften methyl or ethyl methacrylates.

The methacrylate monomers are flammable organic compounds with relatively low flash points. When handling them, adequate ventilation should be provided and open flames, static electricity, and other possible sources of sparks or flames should be eliminated.

The vapors of the methacrylate monomers, like most organic solvents, are somewhat toxic (7, 8, 9, 10) and precautions should be taken to avoid unnecessarily prolonged exposure to them. Working areas should be well ventilated.

Removal of Inhibitors

The methacrylate monomers as shipped contain hydroquinone as an inhibitor to prevent polymerization during shipment and storage. Inhibited monomers will remain liquid for at least two months at room temperature and longer periods under refrigeration. Although it is possible in many cases to counteract the effect of the inhibitor by adding an excess of catalyst, hydroquinone imparts an objectionable yellowish color to the finished embedment and should be removed prior to polymerization.

The inhibitor can be removed by washing the monomer with 20 parts by weight of a 5% sodium hydroxide-20% sodium chloride solution per 100 parts of monomer. Stir or shake the mixture continuously for at least 10 minutes to insure complete reaction between the hydroquinone and the caustic. Allow the mixture to separate into two layers, draining off the top (monomer) layer, then filtering it through coarse filter paper. Once the inhibitor has been removed, the monomer must be used promptly or stored at a temperature of 40° F. or less. Unless maintained at a sufficiently low temperature, uninhibited monomers may polymerize on standing.

Catalysts

The most practical method for initiating polymerization of acrylic monomers involves the use of heat in combination with certain soluble organic peroxide catalysts such as benzoyl peroxide, 2,4-dichlorobenzoyl peroxide, acetyl peroxide, lauryl peroxide, and tertiary-butyl hydroperoxide.

The optimum amount of catalyst will depend on the thickness and size of the casting, the polymerization conditions for each type of specimen, and the catalyst used. In general, catalyst concentrations in the range of 0.02 to 0.1% by weight of monomer are sufficient.

The catalyst should be added to the inhibitor-free monomer and dissolved by stirring. Filter the resulting solution to remove any undissolved particles. After the catalyst has been added, the monomer mixture should be used immediately or stored at 40° F. or below. At these temperatures, it will remain liquid and usable for several weeks. It is good practice to make up at one time only as much catalyzed monomer as can be used in a day's work.

Preparation of the Mix

Two principal types of casting mix are generally used for cast acrylic embedments:

1) A liquid casting syrup which can be polymerized either by the oven or autoclave methods.

2) A casting slurry which can be polymerized only by the autoclave method; the slurry is so viscous that air bubbles cannot be completely removed before polymerization and must be forced into solution under autoclave pressures.

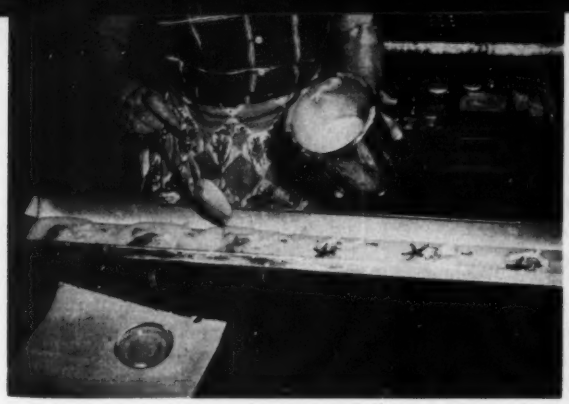
Casting syrups provide optimum optical clarity. Casting slurries have a tendency to show a slight internal graininess but show much less shrinkage than casting syrups.

Partially polymerized monomer casting syrup can be prepared by heating the catalyzed inhibitor-free

First layer of slurry is poured into prism-shaped, highly polished metal mold. Small molds in foreground are used for any remaining slurry

Decorative objects are accurately located on top of gelled slurry with aid of frames which are removed before additional slurry is poured

All photos with this article courtesy Plastic Embedment Co.



Prior to pouring the top layer, all objects are completely surrounded with slurry. This additional step aids in eliminating trapped air

As final step in embedment operation, mold is filled to top with slurry. After final cure, embedment is ready for finishing operations

monomer in relatively small quantities on a hot water or steam bath. The mixture should be stirred or shaken continuously while being heated. The polymerization reaction is highly exothermic and once the polymerization has started, the mass may tend to boil if the heat of reaction is not removed as fast as it is generated. If boiling begins, cool the mass, stirring continuously, until boiling stops.

The viscosity of the mix will increase as polymerization proceeds. Continue heating until the consistency of the monomer approximates that of glycerine at room temperature. The process should be observed continually, since the reaction, unless checked, proceeds spontaneously to complete hardening of the mass. When the mix has reached the proper consistency, cool it to room temperature. The consistency at room temperature should approximate that of heavy molasses. The partially polymerized monomer casting syrup thus prepared should be covered and stored at 40° F. or below until ready for use. At these temperatures, it will remain usable for several weeks. If stored at higher temperatures, it will gradually harden.

Caution: Do not heat monomers over an open flame! Since the monomer vapors are flammable, all electrical connections should be covered and sparks carefully avoided. Exhaust fans should be equipped with sparkproof motors.

Monomer-polymer casting syrup can be prepared by dissolving Plexiglas Y-100 (18 mesh) or Plexiglas DC (40 mesh Y-100) molding powder in catalyzed inhibitor-free methyl methacrylate monomer. Plexiglas DC will dissolve somewhat more easily than Y-100 because of the small average particle size. The viscosity of the mix can be controlled by the amount of the polymer added.

The mixture should be stirred continuously while dissolving. If this is not done, the polymer will settle to the bottom and tend to form a relatively hard gelatinous mass which will be extremely difficult to dissolve.

Casting Slurry

If higher polymer concentrations are used, a slurry can be made which will set to up a gel in a relatively short time. The monomer-polymer mixture should be stirred continuously to insure complete wetting of each particle of polymer and to permit the particles to swell sufficiently to prevent settling. It should then be poured into the mold and let stand until it forms a gel. The monomer-polymer casting slurry will be full of air bubbles when poured, but these will disappear when the mass is cured under pressure in an autoclave.

Molds

The selection of the proper mold to hold the specimen and embedding mix is dictated largely by the size of the specimen and the desired shape of the finished piece. If a number of small items are to be embedded, it may be convenient to select a pan type mold capable of holding all of the specimens, spaced at proper distances to permit sawing the block into sections. In other cases, it is desirable to select a mold of such size and shape that finishing operations are reduced to a minimum. Glass refrigerator containers have been found very useful although other types of glass dishes, open mouth jars, and similar containers have also been used successfully. The container should have a large enough opening to permit easy placement and manipulation of the specimen, yet be of a type which can be sealed with a layer of cellophane to protect the casting mix from contact with the atmosphere. Glass containers have the advantage of permitting a full view of the specimen and the progress of polymerization. With proper caution and suitable polymerization conditions, the polymer block can be removed from the glass mold and the container used again.

The polymethacrylates have a tendency to stick to metal molds. To minimize this tendency, the metal should be highly polished. If sticking still occurs, it may prove helpful to wipe the surface of the mold with stearic acid to serve as the mold release agent. Molds should not be made of copper or copper alloys since these metals have an adverse effect upon polymerization.

Saturating the Specimens

Specimens should be thoroughly impregnated with catalyzed inhibitor-free liquid monomer or casting syrup so that spaces previously occupied by water or air are filled with the monomer. This is particularly important in the case of air encapsulated specimens such as seed pods which would tend to collapse during polymerization if void spaces were not completely filled. Complete impregnation can be accomplished by placing the specimen in a jar containing sufficient monomer to completely cover it. The jar is then put in a vacuum desiccator and subjected to alternate vacuum and atmospheric pressure until the

sample sinks in the monomer and no more bubbles issue from it. The vacuum used should not be so high that the monomer boils.

At this stage the specimen is ready for embedding. In the case of some pathological specimens, it may be desirable to prolong immersion in the monomer to remove excessive amounts of diffusible pigments or fats in such organs as a liver. The liquid monomer should be changed a number of times during the process of saturation.

Selection of Method

The two general methods of making cast acrylic embedments are:

1) Oven polymerization at controlled elevated temperatures and normal atmospheric pressure.

2) Autoclave polymerization at controlled elevated temperatures and pressures up to 150 p.s.i.

The principal advantage of autoclave polymerization is that the high pressures involved raise the boiling point of the monomer, thus minimizing its tendency to bubble due to vaporization, and permitting the use of higher curing temperatures with a resultant faster curing time. In addition, gases trapped or dissolved in the casting mix are forced into and kept in solution and do not show up as bubbles in the finished casting.

Prior to pouring the casting syrup into the mold over the specimen, the mix should be subjected to vacuum to cause dissolved gases to "boil out" of solution. If the dissolved gases are not removed at this stage, they may come out of solution during polymerization as bubbles.

Thin embedment holding 90 trout flies is cut into squares, each with one fly

Supporting the Specimen

A base on which to support the specimen can be made by pouring a ½-in. layer of casting syrup into the mold, then covering the mold with two or three layers of tightly fitted cellophane. If bubbles are trapped in the casting while pouring, let the mold stand until the bubbles disappear. The bubbles can often be made to disappear by subjecting the mold and contents to alternate vacuum and atmospheric pressure. When the bubbles are no longer evident, the syrup should be heated at 110 to 115° F. under normal atmospheric pressure until it forms a gel which is just stiff enough to support the specimen.

Two slightly different techniques are used for oven casting, depending primarily on the thickness of the specimen.

Specimens under 1 in. thick.—Pour a small amount of catalyzed inhibitor-free monomer over the gel base and thoroughly wet the base and sides of the mold. Drain off excess liquid monomer, then pour an amount of casting syrup that will cover the specimen, when inserted, to the desired depth. If bubbles form, cover the mold with cellophane and place it in a refrigerator or subject it to alternate vacuum and atmospheric pressure. Do not allow the casting syrup to stand for any period of time without a cover, either at room temperature or in the oven, because a tough film forms making later operations difficult.

Removing the Specimen

When the syrup is free of air bubbles, remove the specimen from the liquid monomer saturation bath and place it edgewise in the syrup until it resets on the gel base. Then lower it very gradually in such a manner as to avoid trapping bubbles. It may be necessary at this time to add some of the casting syrup to completely cover the specimen, but under no circumstances should the layer be thicker than one inch. Cover with cellophane and if bubbles have formed, place the mold in the refrigerator or subject it to alternate vacuum and atmospheric pressure. Then place it in an oven at 100 to 115° F. for polymerization. As previously stated, polymerization occurs with production of considerable heat. If the layer is too thick, heat dissipates too slowly and bubbles will form. The oven should be provided with an exhaust fan and automatic temperature controls to prevent temperatures from going too high. A block 1 in. thick should harden in approximately seven days at 110 to 115° F. Successive layers of ¼-in. thickness can then be added to obtain a suitable block.

Specimens over 1 in. thick.—Wet the base and sides of the mold with catalyzed inhibitor-free monomer as above. Pour a thin layer of casting syrup over the specimen which had been removed from the liquid monomer saturation bath and placed in the mold. The mold with the specimen is then very carefully sealed using many layers of cellophane. If bubbles have formed, place the mold in a refrigerator or subject it to alternate vacuum and atmospheric pressure. The mold should then be heated at 110 to 115° F. until the layer hardens. This process is repeated until the specimen is covered with approximately ½ in. of polymer. Great care must be exercised to cover the whole specimen and to avoid trapping air bubbles. When the specimen is thus glazed and fixed to the base, proceed carefully to embed by adding successive layers of casting syrup not exceeding ¼ in. in depth, in order not to soften the glaze on the specimen excessively.

Final Heat Treatment

To complete the polymerization, and to anneal the finished embedment in order to reduce stresses due to shrinkage during polymerization, the embedment should be heated to a temperature of approximately 225° F. for at least 2 hr. for each ½ in. of thickness after removal from the mold.

Sample embedments of each type should be tested to determine whether they can withstand the 225° F. annealing temperature without damage.

If not, then lower temperatures have to be used. After heating, embedments in the softer polymers such as butyl methacrylate can be cooled quickly to room temperature;

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embedments in the harder polymers should be cooled slowly. If the part is cooled too rapidly, the surfaces of methyl or ethyl methacrylate blocks may harden while the center is still hot.

Under conditions such as these, severe stresses may be set up in the center of the block as it cools and the polymer may part from the surface of the specimen (11).

Autoclave Polymerization

If casting syrup is used, the preparation of a gel base for supporting the specimens in the mold for autoclave casting is carried out in the same fashion as preparing a base for oven casting, except that bubbles can be disregarded since they will be enforced into solution by elevated pressure during the cure, and will thus be eliminated.

If casting slurry is used, the base is prepared by simply pouring the high-polymer content slurry as soon as it is made and letting it stand (covered with cellophane) until a gel is formed. Again, bubbles can be disregarded since they will disappear during cure.

When the mold has been filled, a layer of cellophane is placed over the top and in direct contact with the top surface of the casting mixture.

The mold is then placed in an autoclave which has been swept free of air with carbon dioxide or nitrogen. Carbon dioxide or nitrogen is then admitted to the autoclave until a pressure of 35 to 150 p.s.i. is reached. The temperature is then raised to 160 to 275° F. depending on the size, shape, and thickness of the specimen and the maximum temperature it can withstand. The elevated temperature and pressure are maintained until polymerization is complete.

In cases where curing temperatures lower than 225° F. were used, the temperature is then raised to 225° F. and held for at least 2 hr. for each ½ in. of thickness. The casting should then be cooled slowly to room temperature while still under pressure. (See "Final Heat Treatment" above.)

Finishing the Embedment

Solid block embedments of ethyl and methyl methacrylate have machining qualities resembling those of Plexiglas (12).

The blocks are first rough cut to approximate size and shape with an ordinary band, circular, or jig saw. A lathe can be used to turn down the faces of the block to insure a flat surface.

Since Plexiglas possesses machining qualities similar to those of brass and copper, metal cutting tools should be used. A coolant (water, or soap and water) may be used if desired.

In the event that no lathe is available, the block may be faced to a smooth surface by fastening emery paper to a block of wood and hand-sanding with a circular motion. It is advisable to start the sanding with a coarse grade of emery paper and finish with a fine grade. The final sanding should be wet, which will give a soft satin finish that can be easily buffed.

Buffing and Cutting

Best buffing results are obtained with a very soft open type of buffing wheel using an abrasive which is a combination of fine alumina with wax or grease binder, and a polishing tallow. The block, when finished, should be colorless and have a high luster.

Embedments in butyl methacrylate can be cut with a sharp knife and sliced readily in a microtome if very thin sections are desired. After slicing, the specimen can be mounted on a microscope slide and the butyl methacrylate polymer removed by dissolving in acetone or other solvents.

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12) See also the following Rohm & Haas bulletins: Pl-2, "Cutting Plexiglas;" Pl-3, "Machining Plexiglas;" Pl-9, "Finishing Plexiglas."

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Spiral Abrasive Drum Covers

Cutting procedures to reduce waste when making replacement drum covers

by William T. Conway*

SEVERAL types of drum grinders that require spirally-wound coated abrasive drum covers are being used in industry for facing wide web sheets of plastic, leather, felt, cork, or rubber. When such drum covers are worn and ready for replacement, the new covers are commonly cut from rolled stock and installed by factory maintenance personnel or by the machine operator. Improper cutting of the cover often leads to waste or malfunctioning of the machine. By following the procedures outlined below, a minimum of coated abrasive stock will be consumed and the new covers will fit their drums accurately.

Two separate procedures are offered, because two basic types of spirally-wound drum machines are in use. On one type of machine, the coated abrasive cover is butt-wrapped on a smooth drum. On the second type, the abrasive cover is overlapped along the spiral. The drum on this type of machine has a spiral groove on its surface to allow for the double thickness of coated abrasive. On both types of machines, the abrasive cover is clamped at both ends of the drum with a suitable take-up device to keep the cover snug on the drum surface.

Practically all of these drum sanders are designed to use 24 in. wide rolls of coated abrasive, either paper-, fiber-, or cloth-backed, or with combinations of these materials. Because the diameter and length of the drums vary according to manufacturer, the abrasive covers must be cut to fit the individual machine. Therefore, measurements must be made on the spot or from specifications written for the particular model involved. Basic drum dimensions are length and diameter, as in Fig. 1, and are to be measured in inches. Basic dimensions for the coated abrasive cover are the length of the taper (T) and of the cover (P), in Fig. 2.

All dimensions in the following calculations are to be in inches.

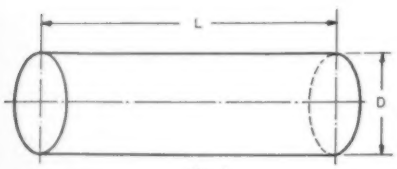

Fig. 1

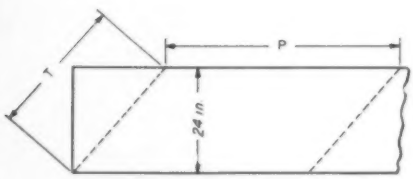

Fig. 2

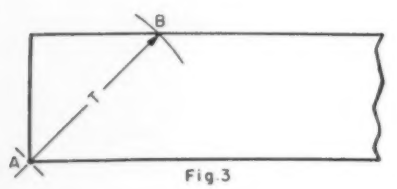

Fig. 3

Butt-Wrapped Spiral Covers

(a) Calculate area of drum (A_D) to be covered.
A_D = length of drum (L) × diameter of drum (D) × 3.14.

(b) Calculate length of abrasive cover (P).

$$P = \frac{\text{area of Drum } (A_D)}{\text{width of coated abrasive (24 in.)}}$$

(c) Calculate length of angle cut or taper (T).
T = diameter of drum (D) × 3.14.

(d) Knowing the length of angle cut (T), scribe an arc (Fig. 3) with a string or rule of radius T from one corner (A) of the coated abrasive until it intersects the opposite edge (B) of the coated abrasive. Cut the cover† on a straight line (AB) between the two points.

(e) Referring to Fig. 4, measure off the calculated length of the cover (P) along the edge of the coated abrasive (AC).

(f) Repeat (d), scribing arc of radius T from point C on Fig 5 to locate point D. Cut straight line CD.

After initial cover has been cut from a roll of coated abrasive, each cover after that is cut by merely repeating steps (e) and (f).

Overlapped Spiral Covers

(a) Calculate theoretical circumference of drum (C_T) and length of angle cut or taper (T).
C_T = diameter of drum (D) × 3.14 + width of overlap (measured parallel to edge of drum).
T = C_T

(b) Calculate area of drum (A_D) to be covered.
A_D = length of drum (L) × theoretical circumference (C_T)

(c) Calculate length of abrasive cover (P)

$$P = \frac{\text{area of Drum } (A_D)}{\text{width of coated abrasive (24 in.)}}$$

(d) Knowing T and P, follow steps (d), (e) and (f) given previously.

* Behr-Manning Corp., Troy, N.Y.
† Always cut covers from the back of the coated abrasive. This results in less wear on edge of cutting knife.

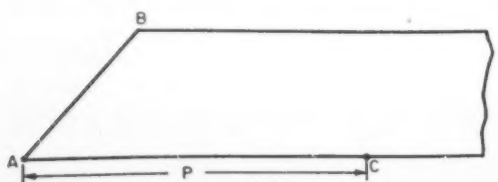

Fig. 4

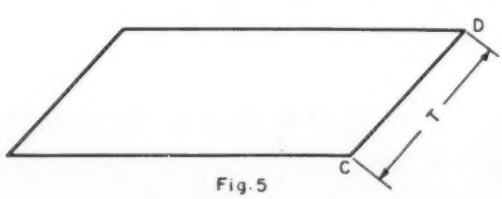

Fig. 5

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PLASTICS*
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Effect of Strains on Heat Distortion

by J. A. Melchore† and H. F. Mark†

CONSIDERABLE information has been published covering the effect of residual strains upon the physical behavior of thermoplastic moldings. Bailey (1)[1] found by annealing extruded rods of polystyrene that more serviceable, craze-free articles resulted. Spencer and Gilmore (2, 3, and 4) discussed the type of strains incurred during injection molding, the effect of these various type strains upon craze-resistance, and a means for reducing these strains by mechanically sealing the mold. By so sealing the mold, excessive packing, which caused frozen orientation, was reduced. Dunlop, Pokigo, and Glick (5) suggested a simplified post-annealing treatment to commercial molders for improving the mechanical and thermal resistances of their moldings. While theoretical aspects have been extensively treated in some of these former studies (6), most of this experimental work was primarily directed toward quality improvement of commercial moldings. These data developed techniques for the commercial molder to produce more craze-resistant moldings either through a mechanical seal in the mold or a post-annealing of the moldings.

This study has been undertaken to determine how these strains of molding influence the rate of distortion of the test specimen during heat resistance testing. Although the A.S.T.M. heat distortion test has good reproducibility, its inadequacies have stimulated this project. For example, similar polymers, possessing identical A.S.T.M. heat distortion temperatures, have often exhibited vastly different degrees of heat resistance when subjected to other tests of heat resistance. More specifically, two similar polystyrenes, both having the same A.S.T.M. heat distortion temperature of 84° C., behaved very differently when subjected to distortion in boiling water (Fig. 1). Although both samples, when subjected to distortion in 100° C. water under the usual 264 p.s.i. stress, exhibited the same rate of distortion up to 0.010 in. total distortion (A.S.T.M. end point); the rate of distortion thereafter was much different.

Heat resistance has been a principal property of consideration in thermoplastic polymers since every application sets a minimum limit in heat resistance. Radio cabinets, washing machine agitators, etc. function at temperatures that invariably infringe the heat distortion temperature of most thermoplastic polymers. In some instances, an improvement of 10° C. in heat resistance would open completely new fields of application. Inasmuch as most thermoplastic polymers do have limited applications because of the lack of high heat resistance, it becomes increasingly important that a means be available for accurately measuring the *intrinsic* heat resistance of new polymers as well as of existing polymers.

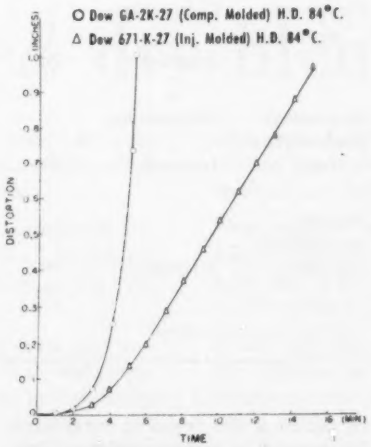


Fig. 1—Distortion of polystyrene in boiling water under 264 p.s.i. stress

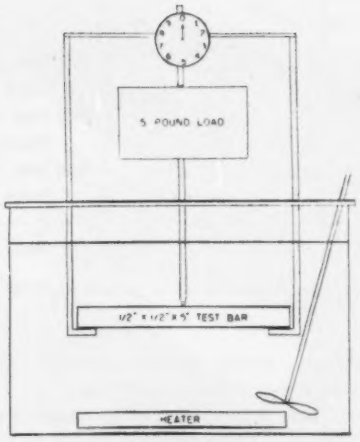


Fig. 2—Distortion test apparatus

The limitations in heat resistance of a polymer will unequivocally be demonstrated in field applications, but it is naturally preferable that these limitations be established within the research laboratory by a standard test. Field evaluation work is costly, time consuming, and re-

* Reg. U. S. Pat. Off.
† Institute of Polymer Research, Polytechnic Institute of Brooklyn, N. Y.
[1] Numbers in parentheses link to references at end of article.

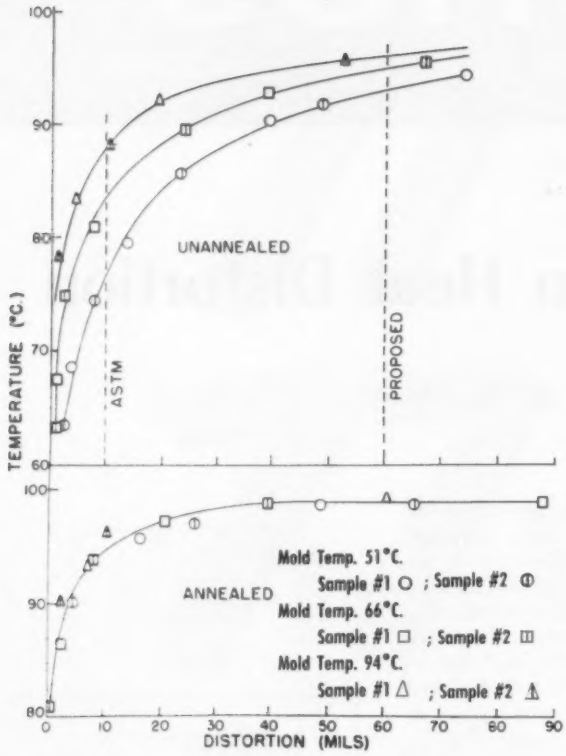


Fig. 3—Heat distortion of polystyrene (regular grade)

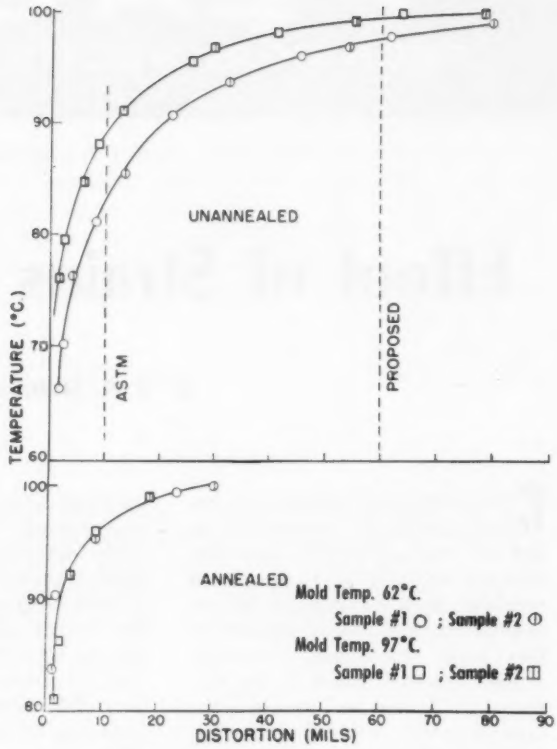


Fig. 4—Heat distortion of polystyrene (heat resistant)

quires rather large quantities of costly experimental polymer.

Upon reviewing the literature as well as the specification bulletins of the polystyrene manufacturers, discrepancies are immediately found in the claimed heat distortion temperatures. It is realized that polystyrene may have different degrees of heat resistance depending upon the amount of residual monomer in the polymer, molecular weight, etc. But even when all these factors are common for commercial polystyrenes these discrepancies in claimed heat distortion temperature are still evident. It is felt that these differences are due to varying degrees of frozen orientation incurred through variations in molding conditions.

Test Procedures

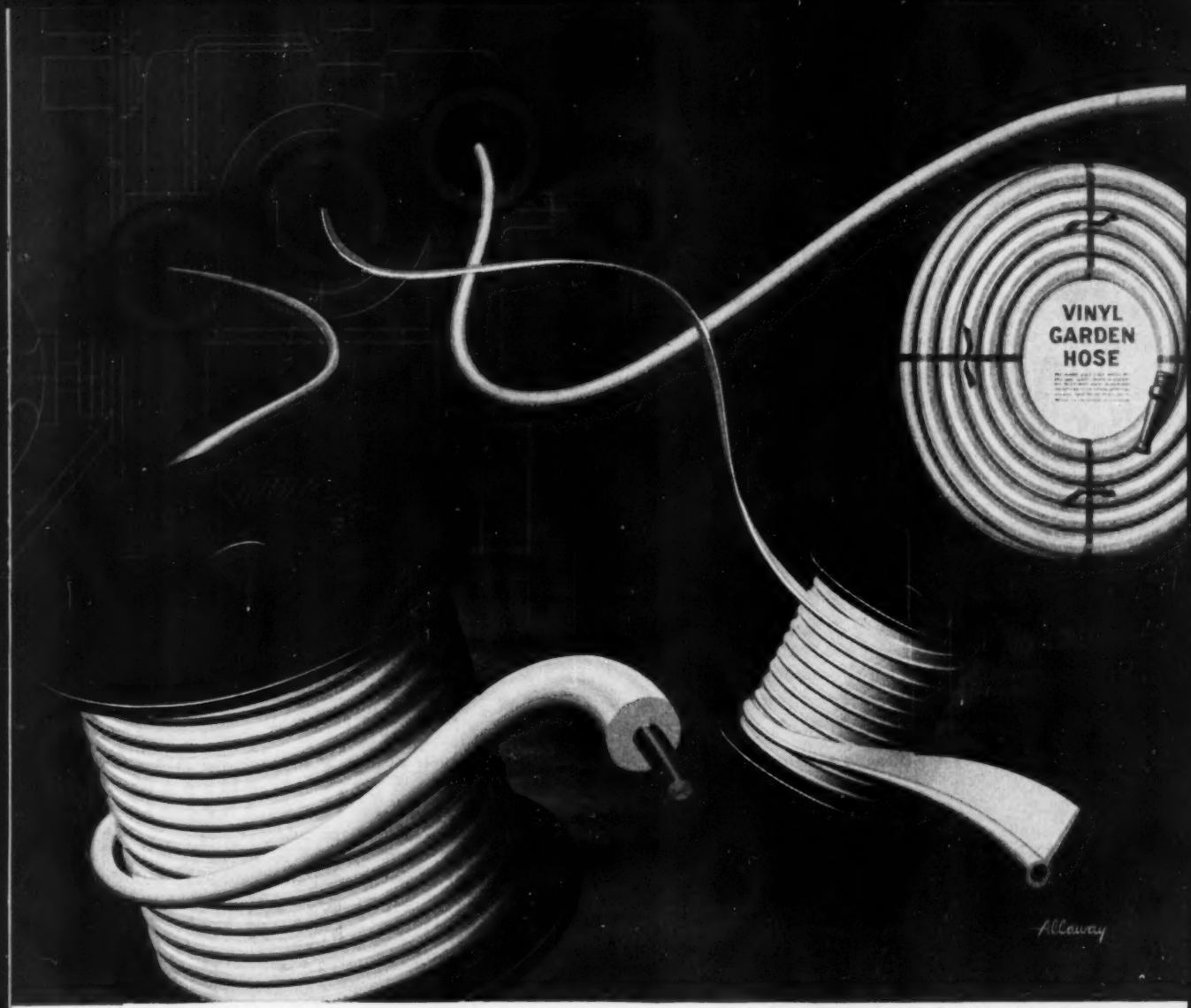
The prime objectives of this study are to determine to what extent these strains-of-molding influence the heat distortion temperature and to devise a means whereby the *intrinsic* heat resistance of a given polymer may be reproducibly determined irrespective of the mode of molding.

Strains of varying degrees were induced or frozen into test moldings by altering the molding conditions. In general, a compression molding, by the nature of the processing, has relatively few strains since little orientation has been produced and since the rate of cooling is relatively slow and uniform. However, an injection molding, depending upon the mold-

Table I—Effect of Molding Conditions upon Heat Distortion Temperature

Polymer	*Type of molding*	*Cylinder temp.*	*Mold temp.*	*Mold Cycle Ram*	*Cycle Cooling*	*Heat distortion temperature[a] (A.S.T.M.-10 mils)*
		°C.	°C.	sec.	sec.	°C.
Polystyrene (reg. grade)	Compression	—	—	—	—	83.8
	Injection	200	51	55	120	76.7
	"	"	66	"	"	84.4
	"	"	94	"	"	88.1
Polystyrene (heat-res.)	Compression	—	—	—	—	87.7
	Injection	200	62	55	120	83.1
	"	"	97	"	"	89.2
Polymethyl methacrylate (reg.)	Compression	—	—	—	—	65.0
	Injection	200	55	55	120	65.0
	"	"	86	"	"	68.3
Styrene-acrylonitrile copolymer	Injection	200	68	55	120	83.4
	"	"	99	"	"	88.4

[a] Average of two test specimens.



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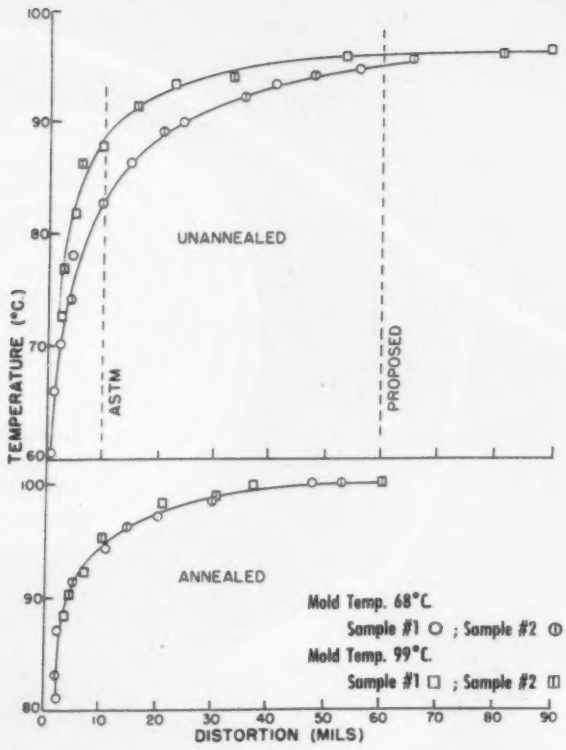

Fig. 5—Heat distortion of polymethyl methacrylate (regular)

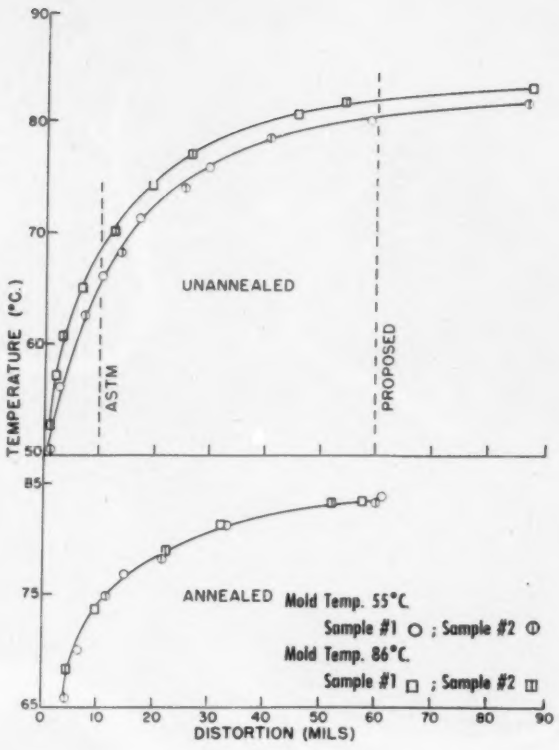

Fig. 6—Heat distortion of styrene-acrylonitrile copolymer

ing conditions, may contain many strains. Factors influencing the extent of these strains include cylinder temperature, mold temperature, dwell time of ram on polymer, pressure, cycles, mold designs, etc. In this analysis, injection molded test specimens have been prepared to possess varied degrees of induced strains by varying only the mold temperature, holding all the other molding variables constant throughout.

All test specimens were ½- by ½- by 5-in. bars. Four polymer types were both compression and injection molded into test specimens:

1. Polystyrene (regular grade)
   Dow GA-2K-27
2. Polystyrene (heat-resistant grade)
   Dow 671-K-27
3. Styrene acrylonitrile copolymer
   Bakelite BMC11-B1
4. Polymethyl methacrylate (regular grade)
   DuPont

The compression molded bars were formed in a positive type mold at 154° C. The molding granules were placed in the heated mold using only contact pressure during a 5-min. pre-heat period; then the pressure on the mold was raised to 1875 p.s.i. and held for three minutes. The molding, while under 1875 p.s.i. pressure, was cooled to approximately 49° C. (about 15 min.) before it was removed. The injection moldings were prepared in a semi-automatic Van Dorn injection press of 2-oz. capacity. The ½- by ½- by 5-in. bar was molded on the diagonal with the runner entering from one end of the bar. The injection molding conditions were:

Cylinder temperature	
Front section	200 ± 1° C.
Back section	200 ± 1° C.
Plunger dwell (forward)	55 sec.
Charging period (for polymer)	4 sec.
Cooling time (in mold)	120 sec.
Mold temperature	51 to 97° C. (varied as noted)

The injection mold temperature was varied as widely as it was possible to produce good test specimens for that particular polymer (i.e., 51 to 97° C.) holding all other variables constant. By this means, strains of varying degree were "frozen" into the moldings.

A sketch of the distortion apparatus is shown in Fig. 2, p. 141. The test bar was supported over a 4-in. span as shown, with a 5-lb. load applied downward to the bar at the center of the 4-in. span. The temperature of the water bath which was used

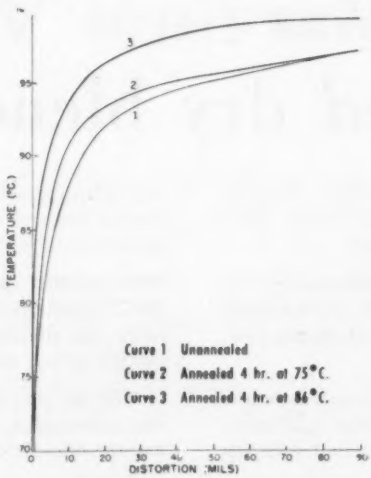

Fig. 7—Effect of annealing temperature upon the heat resistance of polystyrene (regular grade)

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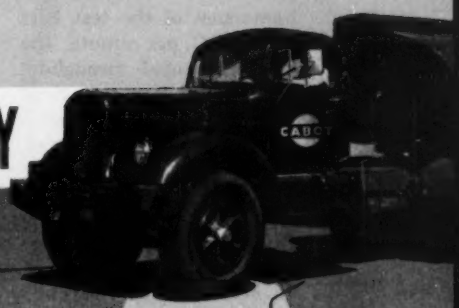

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Table II—Effect of Annealing Upon Heat Distortion Temperature

Polymer	Type of molding	Mold temp.	Heat distortion temp. (A.S.T.M.—0.010-in. distortion) Unannealed	Annealed	Annealing temp. (4 hr.)
		°C.	°C.	°C.	°C.
Polystyrene (reg. grade)	Compression	—	84	94	
	Injection	51	77	94	86
	"	66	84	94	
	"	94	88	95	
Polystyrene (heat-res.)	Compression	—	88	97	
	Injection	62	83	97	91
	"	97	89	97	
Polymethyl methacrylate (regular)	Compression	—	65	75	
	Injection	55	65	73	65
	"	86	68	74	
Styrene-acrylonitrile copolymer	Injection	68	83	94	91
	"	99	88	95	

for the immersion of the test bars was increased 2° C. per minute. The bath was well agitated throughout the test. The initial temperature of the bath was 29 ± 3° C. The progressive and accumulated distortion of the bar was recorded at 1-min. intervals over the 30 to 100° C. temperature range. All tests were run in duplicate.

Effect of Mold Temperature

The effect of these molding strains, which generally has been considered to be constant or negligible, may not be neglected, at least not in the distortion range used in the A.S.T.M. test wherein the total measured distortion is only 0.010 inch. These residual or "locked-in" strains of molding have been found to contribute a substantial and *variable* part of the 0.010-in. distortion of this test. If the inherent heat distortion temperature of a polymer is to be realized, this 0.010-in. distortion should in its entirety result from plastic flow alone and not in a large and varying degree from the relief of unknown quantities of strains produced from fluctuations in molding conditions. For this study, the extent of these strains in a molding has been varied by altering the molding conditions. Molding conditions that produce a highly strained molding for one polymer do not necessarily cause the same amount of strains in a molding of another polymer.

The reproducibility of these heat distortion data has been shown in the following graphs to be generally good. The heat distortion temperature of a given batch of polymer has been made to vary as much as 11° C. by altering the mold temperature so as to induce varied degrees of strains in the moldings (Figs. 3, 4, 5, and 6 and Table I).* The lower the injection mold temperature was maintained, the lower was the heat distortion temperature; the higher the injection mold temperature was, the higher was the heat distortion temperature as a result of reduced strains through partial annealing in the mold.

Effect of Annealing

When the test bars that had been molded under varied conditions were annealed in a circulating air oven for 4 hr., the differences in heat distortion temperature were minimized to within the experimental limits of the heat distortion test. As would be expected, the temperature at which the annealing was accomplished was rather critical. The effect of annealing temperature upon heat distortion temperature for a given polymer is illustrated in Fig. 7, p. 144. It is noted that an annealing temperature of 75° C. was too low, while 95° C. produced so much shrinkage and warping of the test specimen during the annealing operation that further testing was impractical; 86° C. was found to be a satisfactory annealing temperature for this particular grade of polystyrene.

While it has been shown that strains can be pre-released from moldings through annealing to yield a reproducible heat distortion temperature regardless of the molding conditions (Table II and Figs. 3, 4, 5, and 6), it is obvious that the optimum annealing conditions would first have to be experimentally determined for each specific polymer before the actual heat distortion test could be run on the test specimen.

The discrepancies in heat distortion temperatures due to molding conditions also became less significant when the distortion temperature was recorded at a distortion greater than the prescribed 0.010-in. of the A.S.T.M. test (Fig. 3, 4, 5, and 6 and Table III).† At 0.060-in. distortion, these differences were minimized. The first polymer tested exhibited a variation of 11° C. in A.S.T.M. heat distortion temperature due to variations in molding strains. When the distortion temperatures for the various moldings of this polymer were recorded at 0.060-in. total distortion, then only a 3-degree spread was detected among these moldings. While 3° C. was slightly more than the experimental error, it was obvious that a definite advantage existed in measuring the heat distortion temperature at 0.060-rather than at 0.010-in. distortion. Similar advantages have been established for three other polymers (Table III).

The comparison of the four types of tested polymers has been further summarized in Table IV, p. 148, showing the maximum differences in heat distortion temperature resulting from strains. The maximum discrepancies in heat distortion temperature have been compared at two distortion points—0.010 (A.S.T.M.) and 0.060 inch.

It was observed that more reproducible values for heat distortion temperature were consistently obtained when the heat distortion temperatures were recorded at 0.060-in. distortion instead of the A.S.T.M. 0.010-in. distortion.

In order to accentuate the effect

* Figures 3 and 4 appear on p. 142, Figs. 5 and 6 on p. 144, Table I on p. 142.

† Table III appears on p. 148

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Table III—Effect of Measuring Heat Distortion Temperature at a Greater Distortion

Polymer	Mold type	Mold temp.	Heat distortion temperature: Unannealed, At 0.010 in.	Unannealed, At 0.060 in.	Annealed, At 0.010 in.	Annealed, At 0.060 in.
		°C.	°C.	°C.	°C.	°C.
Polystyrene (reg. grade)	Compression	—	84	95	94	98
			— Max. Diff. 11° C.	— Max. Diff. 3° C.	— Max. Diff. 1° C.	— Max. Diff. 1° C.
	Injection	51	77	93	94	99
	"	66	84	95	94	98
	"	94	88	96	95	99
			(Ave. 83)	(Ave. 95)	(Ave. 94)	(Ave. 99)
Polystyrene (heat-res.)	Compression	—	88	99	97	100[a]
			— Max. Diff. 6° C.	— Max. Diff. 1° C.	— Max. Diff. 0° C.	— Max. Diff. ~=0° C.
	Injection	62	83	98	97	100[a]
	"	97	89	99	97	100[a]
			(Ave. 87)	(Ave. 99)	(Ave. 97)	(Ave. ~=100)
Polymethyl methacrylate (regular)	Compression	—	65	82	75	85
			— Max. Diff. 3° C.	— Max. Diff. 1° C.	— Max. Diff. 2° C.	— Max. Diff. 2° C.
	Injection	55	65	81	73	83
	"	86	68	82	74	83
			(Ave. 66)	(Ave. 82)	(Ave. 74)	(Ave. 84)
Styrene-acrylonitrile copolymer	Injection	68	83	95	94	100[a]
			— Max. Diff. 5° C.	— Max. Diff. 1° C.	— Max. Diff. 1° C.	— Max. Diff. ~=0° C.
	"	99	88	96	95	100[a]
			(Ave. 86)	(Ave. 96)	(Ave. 95)	(Ave. ~=100)

[a] Extrapolated.

Table IV—Comparison of Heat Distortion Temperatures at 0.010- and 0.060-in. Distortions

Polymer	Maximum difference in heat distortion temperatures due to strains of molding: Using 0.010-in. distortion (A.S.T.M.)	Using 0.060-in. distortion
	°C.	°C.
Polystyrene (reg. grade)	11	3
Polystyrene (heat-resistant)	6	1
Polymethyl methacrylate (reg.)	3	1
Styrene-acrylonitrile copolymer	5	1

Table V—Inter-Dependency of Transition Temperature and Mold Temperature Upon Strain Tendencies During Molding

Polymer	Max. Scatter in heat distortion temperatures[a]	Transition temp. minus mold temp.	Transition temp.[b]	Mold temp. (minimum)[c]
	°C.	°C.	°C.	°C.
Polystyrene (regular)	11	44	95	51
Polystyrene (heat-resis.)	6	35	97	62
Styrene-acrylonitrile copolymer	5	27	95	68
Polymethyl methacrylate	3	19	74	55

[a] Maximum spread in heat distortion temperatures due to strains induced during molding.
[b] The transition temperature was taken as the heat distortion temperature of the annealed molding.
[c] Lowest mold temperature at which satisfactory moldings were produced.

of these strains upon heat resistance, every effort was made to mold each of the four polymers at as great a spread in mold temperature as would produce maximum strains. For some of these polymers, this was not fully achieved because of bubble formation in the test bars during injection molding. Since all the molding variables except mold temperature were being treated as fixed variables, no attempts were made to produce bubble-free bars through alterations of other molding variables. If samples #2 and #4 (Table IV) could have been molded at a mold temperature as low as that for sample #1, it was felt that the differences within sample #2 and #4 would have been just as great as that within sample #1. Although the lowest operable mold temperature for sample #3 (polymethyl methacrylate) was almost as low as that for sample #1 (polystyrene), the transition temperature, or point at which strains become "set" or frozen-in, was much lower for poly-

(Continued on p. 211)

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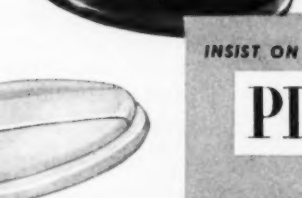

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Stabilization of Polyvinyl Chloride

by Gerry P. Mack*

Hundreds of compounds have been suggested as stabilizers to protect polyvinyl chloride against breakdown by heat and light. This article reviews the theory of the action of the stabilizers and discusses the merits of the various commercial types, including lead, calcium, strontium, barium, tin, cadmium, and zinc compounds.

Recent developments in epoxy stabilizers and chelating materials are described. The latter are complexing agents which serve to clear up haziness caused by some metallic compounds as well as to improve the stabilization of the vinyl resin. Synergistic effects are obtained by the use of combinations of metallic stabilizers, resulting in greater protection than is imparted by either component used alone in like quantity.

INITIALLY, the thermal degradation of polyvinyl chloride is a dehydrochlorination reaction. In an atmosphere of nitrogen the rate tends to approach a steady state and is not affected by a build-up of hydrogen chloride. If oxygen is present, the rate increases with time and the reaction is autocatalytic with respect to hydrogen chloride. Further, in the early stages of degradation in the presence of oxygen, there also seems to be chain scission and cross linking. These reactions can be followed by intrinsic viscosity measurements; first there is a drop in viscosity in the early stages of degradation indicating scission, then a gradual increase indicating cross-linking.

Though this dehydrochlorination reaction used to be considered the principal one, it is now recognized that when hydrogen chloride is split out of the chain the result is a conjugated polyene system, which is prone to oxidation. Further, it has been pretty well established that these two mechanisms are in operation when polyvinyl chloride degrades regardless of the energy source for the reaction.

The rate of degradation can be followed by color changes in the polyvinyl chloride specimen under study. The color of the specimen starts to deepen as would be expected from the work of Hausser, Kuhn, and their co-workers on polyene systems (2).[1] In general, the greater the degradation, the greater the increase in depth of color and absorption further into the infra-red region of the spectrum. Visually this is followed by the color change in the specimen which usually progresses from a pale yellow, to a darker yellow, to gold, and finally to black.

With the polyene system formed and plenty of oxygen available during the working of the polyvinyl chloride on mills and calenders, it is only natural to expect that these polyene groups will be vigorously attacked and oxidation will occur. The oxidation reaction is now generally accepted as one of the principal mechanisms in degradation of polyvinyl chloride. The first proof that such a reaction was going on was reported by Boyer (1) when he mentioned the presence of carbonyl groupings in heat-degraded polyvinylidene chloride, but he attached no special significance to its presence. Fox and his co-workers (5) made a more complete study and definitely determined that in a heat-degraded polyvinyl chloride resin there was a strong absorption at 2730 A., indicating the presence of carbonyl groups. It has been suggested that these carbonyl groupings were formed by oxidation of the heat-induced polyene systems by reaction of the type suggested by Holman (6, 7) and Farmer (4). This situation is closely related to the oxidation of unsaturated fats, particularly those with conjugated double bonds. As a matter of fact, Fox and his co-workers (5) noted this similarity and published the light absorption curves of heat-degraded polyvinyl chloride, oxidized alpha-eleostearic acid, and crotylidene acetone, a known keto unsaturated compound. The striking similarity of the three curves between 2500 and 3500 A. is an indication that similar unsaturated ketone structures exist in these materials. Kenyon (8) has given further evidence of carbonyl formation.

Summarizing, there are two main mechanisms involved during heat degradation: 1) the splitting out of hydrogen chloride resulting in polymer unsaturation of the conjugated type with resulting color formation attributed to polyene systems and 2) a simultaneous oxidation of these systems, probably to carbonyl groups. These are competing reactions in the presence of oxygen and further these reactions are both in operation whether the degrading influence is heat or light. Additional evidence indicates that the energy source seems to merely change relative rates of hydrogen chloride formation and oxidation. When heat is the main influence, hydrogen chloride formation seems to dominate in the degradation with oxidation being secondary. In case of light, oxidation seems to be the main cause of breakdown.

Light Degradation

The effect of light on vinyl resins is quite different from that of heat. In the latter case there is considerable discoloration but very little loss of mechanical properties. However, when a vinyl film is exposed to light, loss in tensile strength and embrittlement on prolonged exposure are quite pronounced. The loss in tensile strength is much faster than the decrease in modulus; as a result some light-exposed samples break when subjected to sudden stress and become so brittle that they cannot be handled.

In light degradation oxidation seems to be the main mechanism. It is not catalyzed by HCl. However, the oxidative attack does depend on an initial dehydrochlorination to pro-

* Vice president and director of research, Advance Solvents & Chemical Corp.

[1] Numbers in parentheses link to references at end of article.

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vide points on the chain that are more susceptible to oxidation.

Oxygen in the presence of ultra-violet light attacks the polyene system present in degraded vinyl resins. This can be seen experimentally by taking a heat-discolored film and exposing it to ultra-violet light and oxygen. A bleaching action will take place that is quite pronounced and in many cases the film will be completely decolorized. It is thought that this reaction is carried out by oxygen attacking the conjugated double bond system present which caused the color. By reacting preferentially at these points, the color-bearing structures are broken up and thus the bleaching action takes place.

Another interesting observation is that a polyvinyl chloride resin which is first exposed to light is far less stable to heat than an unexposed material. It is thought that during the light exposure the ultra-violet light catalyzed an initial take-up of oxygen; when the specimen is then subjected to heat, the usual induction period is disposed of and the oxidation reaction proceeds more quickly under heat.

Initial stability of vinyl resins can also be affected by any catalyst residues that may be left in the resin. These can attack the polymer chain during the degradation process, giving points of increased chlorine activity. Further, during polymerization by peroxide catalysts there may be direct oxidation reactions which would result in sensitization to heat and light due to the activation of the chlorine atom in the chain.

It is a well known fact that some branching probably takes place during polymerization. These branches are most likely on carbon atoms carrying chlorine, resulting in tertiary chloride, which can dehydrochlorinate to produce a weak link in the chain, thus making it more susceptible to heat and light. It is known that small amounts of HCl are split out during polymerization. This may account for the great variation in stability, particularly to light, found among commercial vinyl resins.

Light degradation is caused by ultra-violet radiation of wavelength longer than 3000 Angstroms. In solar incident light on the earth's surface the radiation less than 3000 A. in length amounts to less than 5 percent. Thus, in making light tests a suitable light source must be used to obtain the real effect of light degradation.

With the severe changes in mechanical properties of vinyl polymers exposed to light it must be expected that there is also a reduction in molecular weight. This can be followed by measuring intrinsic viscosity of the exposed specimen. In general, the amount of decrease varies with the exposure. If films are exposed for a prolonged period they become insoluble, indicating that not only is there initially a chain scission but also a cross linking reaction that tends to raise the molecular weight.

In highly plasticized films the plasticizer acts as a diluent for the resin; there is a decrease in the rate of cross-linking but chain scission seems to go on at about the same rate. Frequently there is also a bleeding of the plasticizer.

Light Stabilization

Stabilization against light is very important industrially and much work has been done on this subject. From what has been said it would appear that a good light stabilizer should: 1) prevent initial HCl release, thus preventing the chain building a polyene system; 2) be a powerful oxygen absorber, preventing oxidation of the polyenes. The ideal stabilizer would be an anti-oxidant that would be an acid acceptor and effective in preventing oxidation. It must accept acid or be used in conjunction with an acid acceptor; otherwise the degradation will go on rapidly and open up polyene systems through the catalyzed dehydrochlorination step. As an active anti-oxidant it functions to prolong the induction period of the oxidation process because it does not permit the oxygen to attack the vulnerable double bonds in the vinyl polymer chain.

The closest approach to such a material has been found in the organo tin stabilizers. There is some doubt as to whether these materials act as acid acceptors, but there is evidence that they act as chain repairers through the free radical mechanism and probably reduce the cross-linking. They also seem to be anti-oxidants to prevent carbonyl formation and act as light absorbers.

Other light stabilizers are salicylic derivatives, phenolic compounds, especially the blocked phenols, and similar materials. Most of these materials have a tendency to discolor on exposure to light and therefore are not suitable. Opacifiers that transmit little or no light, such as carbon blacks or titanium pigments, are of course helpful where they can be used. Of the complex organic compounds useful for light stabilization outside of the tin salts are the salts of high molecular polyphosphoric acids and salts of their partial esters. In general, these detract from heat stability.

Some of the recent chelating compounds help light stability, especially when used with metallic salts. Some of these complex phosphorus compounds have an active hydrogen, which reacts with alkaline metals as well as with chlorine. They also can add to organic double bonds. They are effective as anti-oxidants in oils and probably function in a similar way in vinyl compounds. Insufficient experimental work has been done on these to postulate exactly how they function.

An ideal stabilizer or a stabilizer system should: 1) prevent HCl release or absorb hydrogen chloride and combine with it; 2) prevent polyene and carbonyl formation; 3) act as a light stabilizer, either by acting as an anti-oxidant or ultra-violet light screener.

In general, to test a stabilizer it must be used in a plasticized compound. This produces a different condition from tests on a granular polymer. In the first place the polymer undergoes an exposure to heat and oxygen during the milling process and, secondly, as the process progresses the polymers are solvated by the plasticizer.

In the presence of air the function of metallic stabilizers seems to be to prevent color formation rather than to inhibit the formation of hydrogen chloride (3, 5). Exactly how they do this has not been clear until now due to the lack of experimental work with sufficient metallic stabilizers. However, recent work has produced evidence to show that some metallic stabilizers probably function as oxidation catalysts for disruption of the chromophoric polyene groups. This is paralleled in the use of heavy metal soaps (driers) as oxidation catalysts.

Kenyon (8) used a C_{14} labeled

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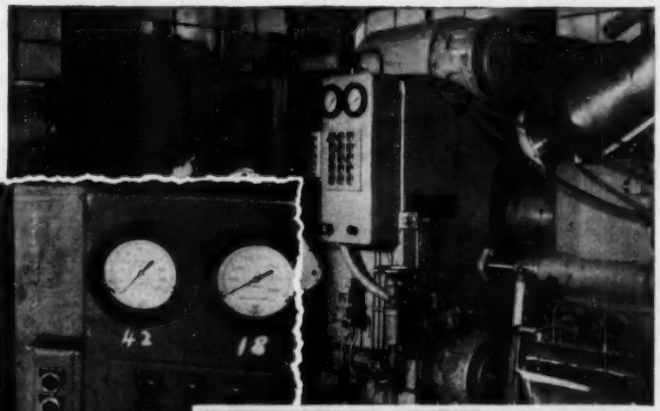

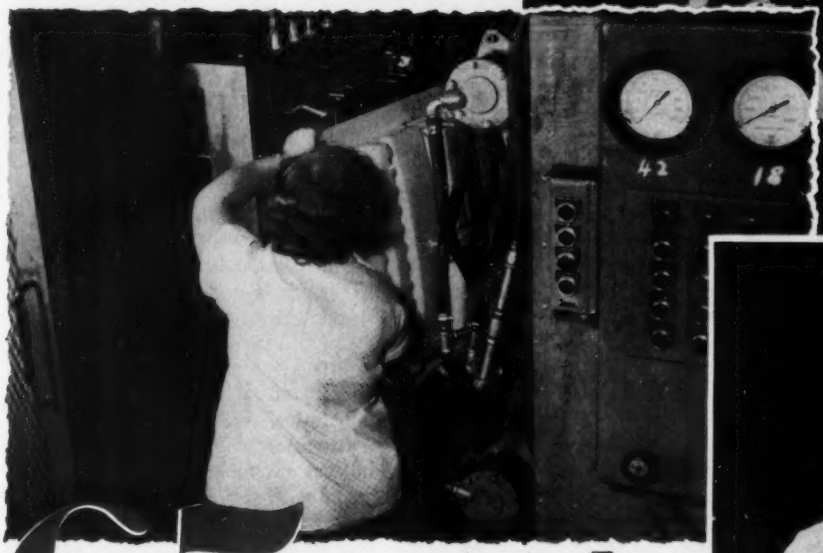

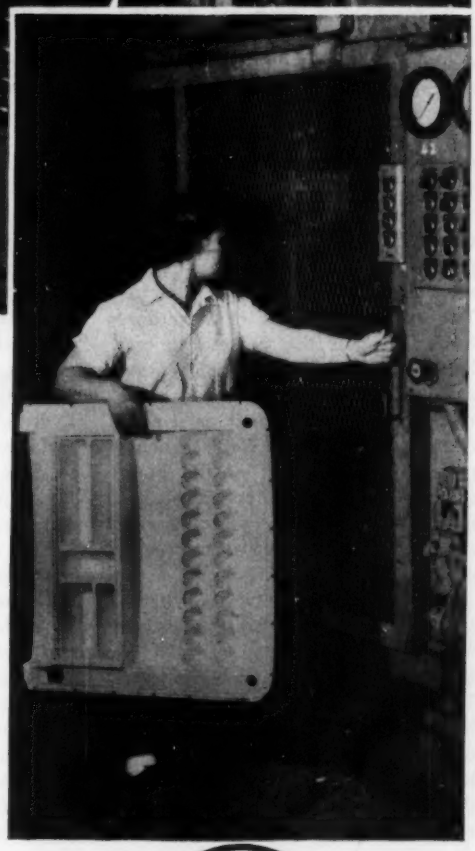

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butyl group in dibutyl tin diacetate as a means of detecting the course of stabilization. When polyvinyl chloride is irradiated by light of wavelengths greater than 2700 A. in the presence of the labeled dibutyl tin diacetate, an increase in the retained beta activity with time of irradiation is observed. After irradiation, the stabilizer was extracted by dissolving and reprecipitating the polymer a number of times until constant retained activity was observed in the polymer film. Polyvinyl chloride stabilizer with C_{14} carboxyl acetate labeled dibutyl tin diacetate showed no change in the retained beta activity with time of irradiation, which proves that the acetate groups are not involved in the reaction.

A mechanism proposed for the explanation of beta activity due to reaction of polymer groups with butyl radical is as follows:

$$R^{\cdot} + AC{-}Sn(C_4H_9)_2{-}AC \longrightarrow RC_4H_9 + C_4H_9Sn(AC)_2$$

where R· is a radical formed by a previous extraction of a hydrogen atom from the polyvinyl chloride. The exact mechanism of how these radicals repair the polymer is not known. The tin stabilizer could act as a scavenger for hydrogen chloride and thus remove it as a condensation catalyst for carbonyl groups. The addition of the butyl group to the polymer radical has blocked further cross-linking and oxidation at this one particular point.

This work by Kenyon substantiated Fox's early work and accounts for the tremendous commercial popularity of organo tin stabilizers. They are the closest approach to an ideal polyvinyl chloride stabilizer in that they: 1) can act as acid acceptors, and 2) prevent polyene formation and subsequent ketone unsaturated groupings by a) acting as a chain repairer, that is, giving up free butyl radicals to prevent unsaturation, and b) giving excellent ultra-violet light stability where it may act both as an anti-oxidant and light screener.

It is significant to note that many other compounds have been investigated to see if they will prevent carbonyl formation, using ultra-violet and infra-red light studies, but so far all of this work has been to no avail and nothing has come up approaching the tin stabilizers.

Lead Stabilizers

Hundreds of compounds have been suggested as stabilizers for polyvinyl chloride. The following discussion is limited to those in general use in the United States at the present time.

Lead stabilizers were among the first to be used with polyvinyl chloride resins. They are still used in the United States, particularly in electrical applications. Litharge or lead monoxide was one of the first stabilizers in this class. It is a good acid acceptor and has good electrical properties and was quite popular for a while. Its chief drawbacks are its high reactivity with plasticizers and other compounding ingredients, and poor color stability.

White lead or basic lead carbonate is an improvement and is color stable, but it too has drawbacks. When approximately 30% of the total metallic lead content (80%) is used up during stabilization, presumably converted to lead chloride, gassing is encountered by the release of carbon dioxide from the basic lead carbonate. To overcome this drawback hydrous basic lead silicate was introduced. This salt provides basic lead to react with hydrogen chloride to approximately the same extent as white lead, but it does not gas. Electrically it is good but it has the drawback of absorption of moisture.

Next came the lead orthosilicates-silica gel complexes. They are not outstanding as heat stabilizers but have the advantage of volume-cost consideration, low tinting strength (making deep shades possible), and the silica gel content seems to absorb and retain breakdown products, particularly fatty acid types, and prevent spewing.

Another lead compound is the hydrous tribasic lead sulfate. It is the most basic, color stable, white lead compound on the market.

In the last few years much work has been done on organic lead stabilizers. One of the first of these was lead stearate. It is still extensively employed, but mostly as a lubricant and secondary heat stabilizer. Next came the dibasic lead stearate; it is used in the same fashion as lead stearate, but gives better clarity. When using these stabilizers the ratios must be carefully controlled so that blooming in the film is not encountered, causing heat sealing difficulties in many cases.

Dibasic lead phthalate has been recommended as a heat and light stabilizer. Its light stabilizing comes from its ability to absorb ultra-violet light.

The most recent development in this group is dibasic lead phosphite, which is used extensively. It is an attempt to make a lead stabilizer having good heat and light stability.

Calcium Stabilizers

Calcium compounds were also considered as vinyl stabilizers. Their relatively poor heat stability soon relegated them to use as lubricants and their most important use at present is in this application, as well as in non-toxic formulations. Besides the stearate, the ricinoleate is also available. Both have the disadvantage of spewing in high concentration, causing heat sealing difficulties.

Attempts to improve calcium stabilizers brought out calcium acetoacetate. That too had many drawbacks, among which are pigmentation of film and solubility, and at present it is used only in special applications, particularly in organosols.

Strontium Stabilizers

Seeking a better heat and light stabilizer than calcium, the strontium stabilizers were first offered about 12 yr. ago. Stabilizers SN and V-1-N were more or less standard in the vinyl field at that time and are still widely employed. The SN is based on naphthenic acid and in many applications the odor of this acid is objectionable. Therefore, a hundred different acids were investigated and the effect of the anion portion of the stabilizer with strontium was studied to see if superior products could be developed. From a research viewpoint many very excellent strontium stabilizers were synthesized, but the acids were usually very expensive to make.

A compromise was made and stabilizer V-1-N was developed, based on the fact that the research work indicated that salts of alpha-substituted acids were the best as stabilizers for both heat and light stabil-

(*Continued on p. 218*)

At Kurz-Kasch, Inc., Dayton, Ohio, uniform preheating with THERMEX Preheating Apparatus produces stronger, more dimensionally accurate radio cabinets. A typical job is exhibited here by Victor G. Reiling, Vice-President in Charge of Manufacturing and J. K. Widmer, Assistant Sales Manager.

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

BRITISH STANDARDS FOR POLYTHENE TUBING. Brit. Plastics *26*, 229 (June 1953). A resume is given of British Standard 1972: 1953—Polythene Tube for Cold Water Services and British Standard 1973: 1953—Polythene Tube for General Purposes, Including Chemical and Food Industry Uses. For cold water service a normal and heavy gage tube are specified. Weights and working pressures are included in the specifications. General purpose tube is specified in three grades, each with a different specific viscosity. The standards are published by the British Standards Institution, 24 Victoria Street, London, S. W. 1, England.

HOW TO TELL QUALITY IN TEFLON. I. D. Press. Materials & Methods *38*, 64-6 (July 1953). Teflon is shaped by methods similar to powder metallurgy techniques. Although classified as a thermoplastic it cannot be melt-molded or melt-extruded. The problems of the Teflon fabricator, including spotting, porosity, dimensional instability, and non-uniformity of the molded part, and how each affects properties are discussed. The source of these difficulties can usually be traced to the production of the semi-finished shapes and/or the final fabricated part. Two tests for inspection purposes are described. A test in which a rod is bent over a mandrel will indicate defective stocks by lateral cracks; a penetrant dye test checks porosity and incipient cracks.

Materials

CURRENT DEVELOPMENTS IN SILICONE-GLASS FIBER LAMINATES. J. K. Hyde. Brit. Plastics *26*, 174-76 (May 1953). Difficulties encountered in producing silicone resin-glass fiber laminates together with results on the improved present dry materials are presented. Mechanical properties, and general electrical properties are presented in tabular form. Moisture absorption still is a problem affecting the electrical properties.

BOIS DURCI — CENTENARY OF AN EARLY MOULDING MATERIAL. E. H. and E. R. Pinto. Brit. Plastics, *26*, 168-169 (May 1953). An historical report is presented on a material patented in 1856. The patent is for a material "which may be employed as a substitute for wood, leather, bone, metal, or other hard or plastic substance," and was composed chiefly of sawdust and albumen.

GLASS-REINFORCED PLASTICS—RECENT CHANGES AND DEVELOPMENTS. D. G. Hodgson and G. Ader. Plastics (London) *18*, 202-204 (June 1953). What has caused the relatively slow development of the glass-reinforced plastics industry in Britain and how has this picture changed recently? The questions are answered both economically and technically. Originally only continuous filament woven cloth was available, but now glass roving, chopped strand mat, and cheaper cloths are available at about ⅓ of the cost of high strength cloth. From only three or four resins the resin production has grown to innumerable types for all purposes and the costs have been cut almost in half. Improvements in production methods such as preforming and matched die molding are making production of uniform items cheaper by cutting down rejects and waste.

POLYESTERS—SOME NOTES ON THEIR BASIC CHEMISTRY. J. Rhys. Plastics (London) *18*, 205-206 (June 1953). The chemistry of polyester resins for various uses is discussed in detail. Formulations are shown and the properties of the resins are described. Applications include surface coating agents, molding materials, synthetic fibers, rubbers, plasticizers, and contact and low pressure laminates.

PLASTICIZERS FROM ACONITIC AND TRICARBALLYLIC ACIDS. F. C. Magne and R. R. Mod. Ind. Eng. Chem *45*, 1546-47 (July 1953). Aconitic and tricarballyic acids have three esterifiable groups, making their esters potential plasticizers for many resins. Tests were made to compare the plasticizing properties, tensile strength, modulus at 100% elongation, and brittle temperature of these esters with that of dioctyl phthalate. Vapor pressure, density, and viscosity data were also obtained. Most of the esters equal and some excel dioctyl phthalate in these specific plasticizing characteristics. The results suggest that most of these esters may be substituted for dioctyl phthalate in plasticizing vinyl resin. The esters of higher molecular weight may have particular application in the medium low-temperature field, being about midway between phthalates and adipates in this respect.

NYLON MOLDINGS. E. E. Halls Plastics (London) *18*, 219-221 (June 1953). Nylon as an injection molding material is becoming available in Britain, and nylon moldings are establishing themselves in critical applications. As an engineering material, nylon couples good mechanical and toughness properties with a low specific gravity. The problems of the molding of nylon parts include careful control of temperature, moisture content, mold shrinkage, and particle size. Test data are given on moisture and water effect on several molded nylon parts.

Molding and Fabricating

FOAMED PLASTICS IN AIRCRAFT STRUCTURES. Brit. Plastics *26*, 170-71 (May 1953). Two techniques for applying polyester-based foamed plastics materials to aircraft structures are described. The materials are used as fillers for stiffening various aircraft structures. The techniques of filling an aileron section and of forming expanded radome are discussed in detail.

Applications

ACRYLIC RESINS IN TEXTILE PROCESSING. A. C. Nuessle and B. B. Kine. Ind. Eng. Chem. *45*, 1287-93 (June 1953). The wide variation in physical and chemical properties of the acrylic polymers and their utility as finishes for fabrics were investigated. A large variety of water-soluble, solvent-soluble and aqueous-dispersed emulsion polymers

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may be prepared from the acrylic monomers which include acrylic and methacrylic acids and their salts, esters, amides and nitriles. The polymers range in physical properties from soft and rubbery to very hard and brittle materials. The degree of hardness is reflected in the hand imparted to textile fabrics, although in the case of emulsion polymers extreme hardness may lead to delustering effects rather than hand modification, or to crazing or cracking of the finish unless specific adhesion to the fiber is very high. The acrylics are outstanding in resistance to deterioration by heat, light, chemical fumes, weathering, and aging. Adhesion to textile fibers varies somewhat with polymer composition. Polyacrylic acid has excellent specific adhesion to nylon and enjoys considerable use as a warp size. With sufficient heating, it will combine chemically with nylon to give a very durable finish.

POLY-LINED GLASSINE. Modern Packaging *26*, 133 (Apr. 1953). A new polyethylene lined glassine paper for metal parts, envelopes, and wraps appears to have many desirable qualities not previously available in any one type of packaging material. The material has low water-vapor and gas transmission rates, average Mullen test of 25 lb., pH of 6.5 to 7.5, excellent oil and grease resistance, and excellent aging characteristics.

NYLON-COATED LEATHER. F. Leonard, T. B. Blevins, W. S. Wright and M. G. DeFries. Ind. Eng. Chem. *45*, 773-5 (Apr. 1953). The leather portions of prostheses worn by amputees in intimate contact with the skin are exposed to conditions conductive to rapid deterioration. Acid or alkali sweat, bacterial skin flora, and body heat contribute to breakdown of the leather, development of odor, and the staining of clothing, particularly during the summer months. A soluble nylon applied as a coating prevents deterioration of the leather for periods greater than one year, whereas uncoated parts have become unusable after one or two months. The coating consists of 20 g. of Nylon FM-6501 dissolved in 200 ml. of an 85% isopropyl alcohol-water solution. The coating may be applied by brush or spray. The coating imparts superior abrasion resistance and resistance to bulk sweat,

yet permits water vapor diffusion at a rate necessary to remove normal insensible perspiration.

ONE-PIECE MOLDED GLIDER WINGS. Brit. Plastics *26*, 214-19 (June 1953). The latest addition to the range of large moldings is a high performance experimental wing for a new glider. High-efficiency laminar flow wings such as these must be constructed to close tolerances. This wing, molded of phenolic-impregnated asbestos material, ensures a uniform accurate surface. Each wing half is 30 ft. long and has a 5-ft. chord at the root. The construction of the mold, the molding procedure including lay-up, curing, finishing, and assembly, are discussed in detail. Several diagrams also help to explain the wing construction.

Properties

STRESS-CRAZING OF PLASTICS. J. A. Sauer and C. C. Hsiao. A.S.M.E. Trans. *75*, 895-902 (July 1953). The effects of various factors on the inception and growth of crazing are reviewed and some of the similarities between crazing in plastics, exposure-cracking in rubber, and stress-cracking in metals are described. Stress-strain behavior is reported for crazed, non-crazed, and oriented plastics. Rate of propagation of crazing was also investigated. Results indicate that penetration of crazing cracks in polystyrene can be represented over a limited stress range by a linear function of time and stress. Methods for avoiding crazing include special coatings, annealing, and utilization of working stresses based on crazing onset rather than static fracture stresses.

STRESS AND STRAIN AT ONSET OF CRAZING OF POLYMETHYL METHACRYLATE AT VARIOUS TEMPERATURES. M. A. Sherman and B. M. Axilrod. A.S.T.M. Bulletin No. 191, 65-70 (July 1953). The stress and strain at the onset of crazing of polymethyl methacrylate were determined at 23, 50, and 70° C. The materials tested were commercial cast polymethylmethacrylate sheets of both general-purpose and heat-resistant grades. The tests were made on samples 0.15 in. thick. Load-elongation graphs were made during the tests, and the onset of crazing was observed visually and noted on the graph. The results indicate that a "critical-strain theory" for the threshold of crazing, suggested for polystyrene by Maxwell and Rahm, is not applicable to polymethyl methacrylate. The strain at the threshold of crazing tended to decrease with increase in temperature from 23 to 50° C. Between 50 and 70° C. no consistent trend for the strain at crazing was detected. The stress at the threshold of crazing was about 80 to 95% of the tensile strength at all temperatures.

Testing

RUBBER STRIP ADHESION TESTER. S. A. Eller. A.S.T.M. Bulletin *1953*, No. 190, 41-2 (May 1953). The strip adhesion tester described has the following advantageous features: 1) it is a relatively inexpensive attachment that enables the Scott tension machine to be used in measuring the adhesive strength of bond of flexible materials to metal; 2) the angle of detachment of the flexible material is accurately maintained at 90° to the plane of the base, thereby providing reproducible test conditions and; 3) an autographic plot of the adhesive strength of flexible material to the metal plate is obtained over the entire length of specimen, thereby eliminating personal errors and providing a permanent record of the results.

MODIFIED BOURDON GAGE. J. F. Carley. Ind. Eng. Chem. *45*, 858-60 (April 1953). The grease-filled pressure gage is a cheap, sensitive, and accurate means of measuring polymer pressures. It is virtually unaffected by changes in temperature, its range may be changed quickly, and its maintenance is simple. It can be installed wherever there is room for a ½-in. hole, it can be placed very close to moving parts, and it occupies no volume inside the processing equipment. The gage is easily adapted for continuous recording of pressure.

Correction

Abstract of article entitled "NEW PROCESS FOR THE MANUFACTURE OF FURFURYL ALCOHOL RESIN INTERMEDIATES," (Plastics Digest, MODERN PLASTICS, June 1953, p. 140) was erroneous. Correct summary of cited paper should read: "A process is described for the preparation of furfuryl alcohol resin intermediates which comprises the molecular condensation of furfuryl alcohol in the presence of activated alumina."

U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

RUBBER-RESIN MIXTURE. S. A. Harrison and W. E. Brown (to B. F. Goodrich). U. S. 2,643,987, June 30. Mixtures of butadiene-styrene copolymers with hard copolymers of styrene.

STABILIZER. A. T. Walter (to Carbide and Carbon). U. S. 2,643,988, June 30. Heat-stabilized polychlorotrifluoroethylene resins.

CATALYST. L. A. Auspos and J. B. Dempster (to du Pont). U. S. 2,643,989, June 30. Polymerization of terephthalic esters with cerium compounds.

COPOLYMERS. G. E. Ham (to Chemstrand). U. S. 2,643,990, June 30. Copolymers of acrylonitrile and an N-monoolefinic compound.

INTERPOLYMERS. P. O. Tawney (to U. S. Rubber). U. S. 2,643,991, June 30. Interpolymers of 2-alkenyl 2 alkenoates with 2-alkenyl chlorides.

POLYVINYL ESTERS. L. M. Germain (to Shawinigan). U. S. 2,643,994, June 30. Alkaline alcoholysis of polyvinyl esters.

POLYMERIZATION. H. F. Park (to Monsanto). U. S. 2,643,995, June 30. Emulsion polymerization of vinyl aromatic compounds.

POLYISOCYANATES. C. F. Irwin (to du Pont). U. S. 2,644,007, June 30. Preparation of polyamine hydrochlorides and polyisocyanates.

LUMINOUS BODY. W. V. Etzkorn. U. S. 2,644,113, June 30. Elongated light-transmitting plastic tube containing luminous gas.

SHOE SOLE. J. A. Ciaio. U. S. 2,644,250, July 7. Fibrous glass reinforced thermosetting resin shoe sole.

CLAMP. E. M. Wilmer and W. P. Hunter. U. S. 2,644,497, July 7. Clamp for clamping plastic blocks together in plank construction.

SPRAY. W. Kopperschmidt. U. S. 2,644,717, July 7. Spray for molten plastics.

FOIL. J. P. McGirr (to T. G. McGirr). U. S. 2,644,761, July 7. Metallized plastic foil.

COATING. W. A. Kaye (to Pabco). U. S. 2,644,772, July 7. Polymerizing resins in situ on filler particles.

WOOL TREATMENT. I. P. Hammer and J. B. Rust (to Montclair Research and Ellis-Foster). U. S. 2,644,773, July 7. Control of wool shrinkage by treating with polyamides.

CATALYST. J. D. Calfee and C. A. Kraus (to Standard Oil). U. S. 2,644,798, July 7. Hydroxylated aluminum halide polymerization catalyst.

RESINS. G. F. D'Alelio (to Koppers). U. S. 2,644,801, July 7. Sulfonated aryl acetylene resins.

POLYMER. J. F. Lontz (to du Pont). U. S. 2,644,802, July 7. Tetrafluoroethylene polymer containing polyorganosiloxane lubricants.

SPINNING SOLUTIONS. A. Cresswell (to American Cyanamid). U. S. 2,644,803, July 7. Spinning solutions of acrylonitrile-allyl alcohol copolymers.

PACKING. L. C. Rubin (to M. W. Kellogg). U. S. 2,644,804, July 7. Packing composition of polytrifluorochloroethylene and an inorganic antifriction agent.

SILOXANE. R. W. Martin (to General Electric). U. S. 2,644,805, July 7. Boric acid-methyl polysiloxane composition.

RESIN. H. S. Bloch (to Universal Oil). U. S. 2,644,807, July 7. Polyvinyl acetal resins.

POLYMERS. M. M. Brubaker and R. N. MacDonald (to du Pont). U. S. 2,644,808, July 7. Polymers of N-carboanhydrides.

POLYMERIZATION. J. S. Saylor, Jr. (to Standard Oil). U. S. 2,644,809, July 7. Polymerization of isobutylene with Friedel-Crafts catalyst in chlorofluoroalkane solution.

CELLULOSE ETHERS. J. Downing and J. G. N. Drewitt (to British Celanese). U. S. 2,644,818, July 7. Manufacture of cellulose ethers.

DENTURES. S. J. Hetzel. U.S. 2,645,012, July 14. Denture lining of poly-n-butylmethacrylate.

FILM DRIER. C. N. Edwards (to Hispeed Equipment). U. S. 2,645,031, July 14. Device for drying films of plastic.

PRINTING PLATE. G. C. Brainard and J. Gruver (to Addressograph-Multigraph). U.S. 2,645,178, July 14. Plastic printing plate and the embossing thereof.

TUBING. E. Davis and O. C. Stahl (to O. C. Stahl). U.S. 2,645,249, July 14. Vinyl tubing.

BAG. I. Makrauer (to Sydney-Thomas). U.S. 2,645,591, July 14. Bonding an end closure to a thermoplastic bag.

RESINS. F. J. Hermann (to Reichhold). U.S. 2,645,623, July 14. Reaction product of a polyphenol, an unsaturated carboxylic acid, and a polyisocyanate.

SILANES. M. J. Hunter (to Dow Corning). U.S. 2,645,624, July 14. Silanes and siloxanes containing t-alkoxy radicals.

MELAMINE RESINS. F. A. Bonzagni (to Monsanto). U.S. 2,645,625, July 14. Clear solutions of methyl ethers of melamine-formaldehyde condensates.

COATINGS. B. W. Nordlander and R. E. Burnett (to General Electric). U.S. 2,645,626, July 14. Thixotropic alkyd resin coatings.

RESIN. E. L. Gustus. U.S. 2,645,627, July 14. Polyamine-aldehyde acid adsorbing resin complex with a monoalkyl ester of sulfuric acid.

POLYSILOXANES. D. T. Hurd (to General Electric). U.S. 2,645,628, July 14. Vinyl polysiloxane compositions.

POLYSILOXANES. S. Nietzsche (to Dr. Alexander Wacker Gesellschaft für Elektrochemische Industrie). U.S. 2,645,629, July 14. Accelerated condensing organopolysiloxanes.

RESIN. J. L. Speier, Jr. (to Dow Corning). U.S. 2,645,630, July 14. Phenylol silane-formaldehyde resin.

POLYMERIZATION. W. W. Crouch and E. W. Cotten (to Phillips Petroleum). U.S. 2,645,631, July 14. Emul-

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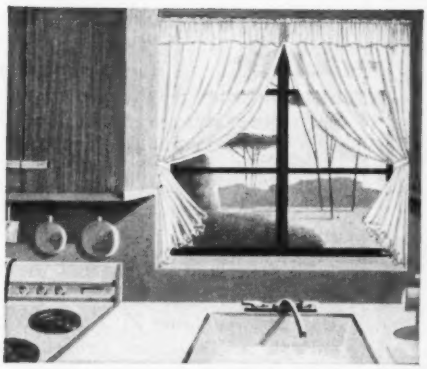

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LINDOL* tricresyl phosphate coal tar base	Technical	Clear transparent liquid	75	1.165 ± .005	0.01 (3)	99	30	1.553
CELLUFLEX* 179C tricresyl phosphate petroleum base	Technical	Clear transparent liquid	150	1.165 ± .005	0.01 (3)	99	30	1.553
CELLUFLEX* 112 a mixed ester	Technical	Clear transparent liquid	40	1.210 ± .005	0.01 (3)	99	30	1.560
CELLUFLEX* TPP triphenyl phosphate	Technical	White flakes	20(4)	1.202 ± .005(1)	0.003 (3)	99	30	1.550(1)
CELLUFLEX* DBP dibutyl phthalate	Technical	Clear transparent liquid	50	1.045 ± .001	0.01	98	—	1.490
CELLUFLEX* DOP dioctyl phthalate	Technical	Clear transparent liquid	50	0.986 ± .002	0.01 (2)	98	—	1.485

(1) @ 60°C. (2) % as phthalic, max. (3) % as phosphoric, max. (4) molten.

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sion copolymerization of sulfur dioxide and unsaturated organic compounds.

RESINS. T. A. Te Grotenhuis and G. H. Swart (to General Tire and Rubber). U.S. 2,645,632, July 14. Resinous copolymers of poly-substituted isopropenyl benzenes.

PLASTIC MILLING. H. A. Swallow (to Carbide and Carbon). U.S. 2,645,813, July 21. Apparatus for continuous milling of plastics.

EXTRUSION, E. G. Bennett and C. L. Willis. U.S. 2,645,835, July 21. Vertical extrusion machine.

DECORATIVE BASE. R. C. Melander. U.S. 2,645,872, July 21. Cord-reinforced plastic decorative base for floral designs.

HINGE. N. W. Roop (to Columbus Plastic Products). U.S. 2,646,187, July 21. Hinge construction for molded parts.

ADHESIVE SHEETS. J. A. McGarry (to Permacel Tape). U.S. 2,646,371, July 21. Adhesively coated sheet material.

PAPER TREATING. C. W. McMullen, R. C. Shaver, and R. L. Titus (to Cowles Chemical). U.S. 2,646,373, July 21. Treatment of paper-making fibers with organosilicon compounds.

PLASTIC RIMS. L. H. Moring (to Coats and Clark). U.S. 2,646,378, July 21. Producing spools with plastic rims.

MOLDING. A. C. Barlow, W. G. D. Carpenter, J. B. Cameron, and J. M. Griffith (to Fairway Aviation). U.S. 2,646,380, July 21. Applying a design to a thermosetting resin during the molding operation.

COATINGS. J. W. Kneisley (to Hercules). U.S. 2,646,410, July 21. Maleic polyester compositions.

GELS. D. E. Sargent and W. F. Amon, Jr. (to General Aniline). U.S. 2,646,411, July 21. Thermoreversible polyvinyl alcohol gels.

TEXTILE SIZE. W. M. Bruner and J. C. Lehr (to du Pont). U.S. 2,646,412, July 21. Urea-polyalkyl acrylic acid textile size.

POLYAMIDE. C. W. Taylor (to Wingfoot). U.S. 2,646,413, July 21. Polyamide plasticized with diacetin.

DISPERSION. R. H. Gillespie (to Kendall). U.S. 2,646,414, July 21. Polyvinyl chloride dispersions.

COPOLYMERS. J. C. Patrick and H. R. Ferguson (to Reconstruction Finance). U.S. 2,646,415, July 21. Copolymers of polythiols, phenols, and aldehydes.

GELATION INHIBITORS. E. E. Parker (to Pittsburgh Plate). U.S. 2,646,416, July 21. Inhibition of gelation of unsaturated polyesters with amine salts.

RIGID THERMOPLASTICS. G. B. Jennings (to B. F. Goodrich). U.S. 2,646,417, July 21. Rigid compositions of vinyl halide polymers with interpolymers of styrene and acrylonitrile.

RESINS. J. L. Lang (to Dow). U.S. 2,646,418, July 21. Polymerizing monovinyl aromatic compounds with rubber.

RESINS. T. J. Suen and A. M. Schiller (to American Cyanamid). U.S. 2,646,419, July 21. Aminoalkane sulfuric acid modified urea-formaldehyde resins.

POLYMERS. P. W. Morgan (to du Pont). U.S. 2,646,420, July 21. Linear condensation polymers containing phosphorus.

POLYMERIC COUPLERS. C. F. H. Allen and T. T. M. Laakso (to Eastman Kodak). U.S. 2,646,421, July 21. Polymeric pyrazolone couplers.

INTERPOLYMERS. D. E. Strain (to du Pont). U.S. 2,646,422, July 21. Cured chlorosulfonated diolefin interpolymers.

POLYMERS. H. W. Wehr and F. B. Nagle (to Dow). U.S. 2,646,423-4, July 21. Polymers of alkenyl aromatic compounds and acrylonitrile.

POLYETHYLENE. H. W. Weir and F. B. Nagle (to Dow). U.S. 2,646,425, July 21. Preparation of polyethylene.

CELLULOSE ACETATE. C. J. Malm and L. W. Blanchard, Jr. (to Eastman Kodak). U.S. 2,646,429, July 21. Manufacture of cellulose acetate with sulfoacetic acid pretreatment.

PIPE COATING. W. C. Ferguson (to Presstite). U.S. 2,646,822, July 28. Plastics coated pipe and fitting.

CASE. F. S. Schade (to National Blank Book). U.S. 2,647,071, July 28. Laminated case construction.

BONDING. W. K. Smith (to Firestone). U.S. 2,647,072, July 28. Joining thermoplastic with heat.

INSULATED CONDENSER. J. Burnham (to Sprague Electric). U.S. 2,647,079, July 28. Insulation for condensers

including polytetrahaloethylene film.

POLYMERIZATION. R. M. Joyce (to du Pont). U.S. 2,647,080, July 28. Light stabilized photopolymerization of acrylic esters.

MOLDED BOX. J. M. McColgan (to Stauffer Chemical). U.S. 2,647,090-1, July 28. Molded phenolic battery box.

ALKYDS. C. J. Meeske and D. Laganis (to Reichhold). U.S. 2,647,092, July 28. Styrene modified alkyd resins.

ALKYDS. C. J. Opp and R. E. Werner (to Interchemical). U.S. 2,647,-093, July 28. Methyl methacrylate modified oil alkyd resins.

PIGMENT PASTE. F. J. Hahn (to Monsanto). U.S. 2,647,094, July 28. Pigment pastes containing styrene-maleic copolymers.

ALKYDS. C. J. Opp and R. E. Werner (to Interchemical). U.S. 2,647,-095, July 28. Methyl methacrylate modified alkyd resins.

VINYL RESIN. L. J. Radi (to Interchemical). U.S. 2,647,096, July 28. Polyvinyl chloride resin containing a Utah coal resin.

MOLDING COMPOSITIONS. G. P. Humfeld and D. A. de Tarta (to Radio Corp.). U.S. 2,647,097, July 28. Reaction product of vinyl chloride polymer and terpene-phenol resin.

PLASTICIZERS. W. M. Smith, Jr. and R. J. Reid (to Firestone). U.S. 2,647,098-9, July 28. Linear polyester plasticizers.

ADHESIVE. F. Salditt (to Scholl). U.S. 2,647,100, July 28. Polyvinyl ether adhesives.

FILM. B. J. Humphrey and R. J. Reid (to Firestone). U.S. 2,647,101, July 28. Film of polyvinyl chloride and butadiene acrylonitrile.

POLYESTERS. J. C. Shivers, Jr. (to du Pont). U.S. 2,647,104, July 28. Polyethylene terephthalate modified with an aminoalcohol.

POLYMERIZATION. H. R. Mighton (to du Pont). U.S. 2,647,105, July 28. Polymerizing epsilon caprolactam.

POLYMERS. V. A. Engelhardt (to du Pont). U.S. 2,647,106, July 28. Alkoxypentadienoate polymers.

POLYMERIZATION. A. W. Barnes (to Imperial Chemical). U.S. 2,647,107, July 28. Iodoform as modifier in vinyl chloride polymerization.

NEW MACHINERY AND EQUIPMENT

Laboratory equipment—An extrusion-laminator unit for preliminary laboratory researches into process problems has been engineered by Frank W. Egan Co., Bound Brook, N. J. It is designed for 24 in. wide paper or other webs for lamination with polyethylene or other plastics. It includes a 2½-in. diameter extruder with heaters, die, and drive; the mechanical equipment mounted on a frame which houses two unroll positions, a laminator, edge-trim slitters, winder, drive, and instrumentation.

The equipment is said to be highly flexible and readily adapted to new experimental formulations and processing operations.

It occupies less than 85 sq. ft. of floor space and weighs about 13,000 pounds.

Injection molding machine—Series 450T 20- and 24-oz. injection machines, developed by Reed-Prentice Corp., Worcester 4, Mass., incorporates several improved design features.

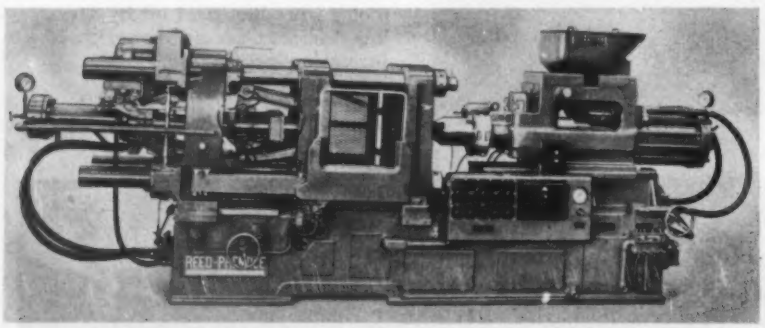
Four tie bars of 5-in. diameter form the frame for the mold locking mechanism and the die platens. The latter measure 45 by 40 in., and the rated casting area in the mold is 200 sq. inches. Both the 20- and 24-oz. machines develop 450 tons positive mold locking pressure and provide 16-in. stroke independent of mold thickness. Die stroke can be varied with a newly developed adjustment mechanism in the toggle cylinder.

The central operating panel, which controls the movement of the die plate and plunger, also houses three electric timers for semi-automatic or fully automatic operation; and a fourth timer governs the time full delivery from both hydraulic pumps is on the plunger.

Heating cylinder for the machines is stated to plasticize up to 125 lb. of material per hour. It is mounted on vertical ways to allow removal from injection housing.

Motor, piping, and hydraulic equipment is mounted at rear of machine. The hopper is designed to accommodate a standard 200-lb. material drum on a 45° angle.

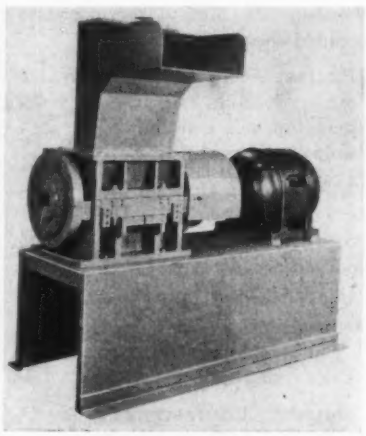
A separate steel cabinet houses electrical controls and two proportioning type pyrometers for temperature control of front and rear of heating cylinder.



Reed-Prentice's series 450T injection machines incorporate several new design features

Granulator and dicer—Equipped with a large flywheel, Model 20 granulator, offered by Cumberland Engineering Co., Inc., Box 216, Providence, R. I., eliminates the preliminary steps of cutting and bandsawing large chunks of plastics scrap to be granulated. Adapted for granulating cylinder purgings from injection machines and bleeder scrap from extruders, the unit is also said to be capable of granulating heavy cast slabs of polystyrene or acrylic. The equipment is of all-steel construction, with an 8- by 20-in. throat opening. Both internal and external seal rings are hardened and ground to prevent abrasion and mutilation. Power is supplied by a 40-hp., 1200-r.p.m. motor, coupled directly to the motor shaft of the machine.

The company also offers a dicer for the cubing of polyethylene, soft vinyls, nylon, acetate, and styrene. Input speeds of this unit range from 10 to 125 ft. per min., depending on material and size cube desired, and it can accommodate sheet stock in sizes from ⅛ to ⅜ inch. Two models are available to handle sheet up to 7 and 14 in. wide, respectively.



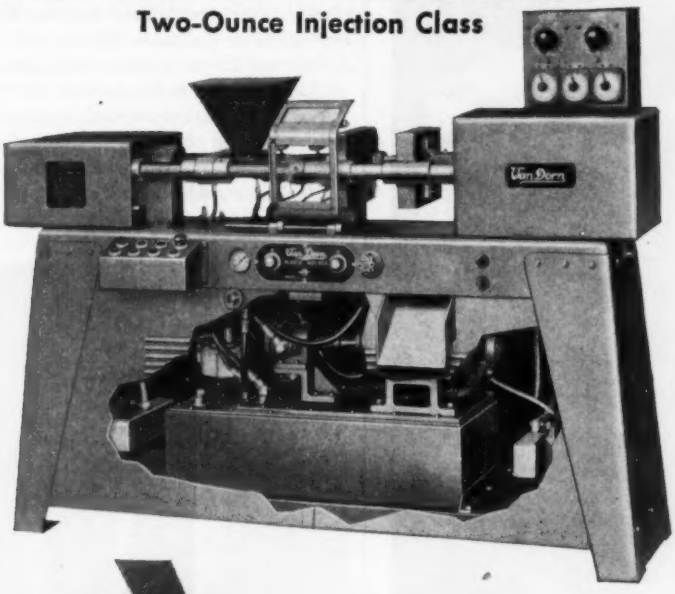
Cumberland's granulator has 8- by 20-in. throat opening, can granulate slabs of cast acrylics and styrene

Mold base—Experience with the recently introduced standard 9- by 8-in. A-R series of mold bases described on page 152 of the June issue of MODERN PLASTICS has now led to the standardization of this same size mold base in the stripper plate series. Both units are produced by Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich.

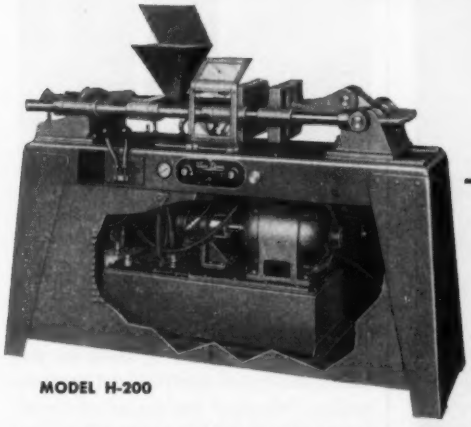
Like the standard A-R series, the new stripper plate series is also intended for the smaller type injection machine, with the difference that its use is indicated for operations requiring a floating plate. The unit fits machines with only 8-in. tie bar clearance and has over 48 sq. in. of usable cavity area. It is available in

Produce Plastics Profitably With This
VAN DORN Equipment

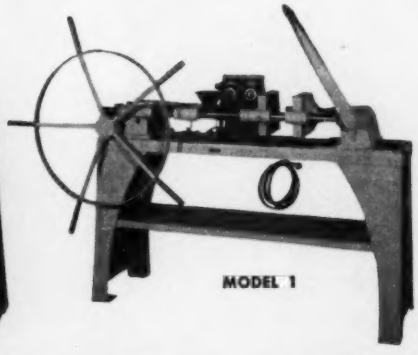
Model H-200—Leader in the Semi-Automatic Two-Ounce Injection Class



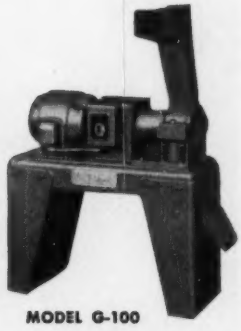
This ultra-modern press molds practically all thermoplastics including nylon. It completes up to 6 operating cycles per minute. Push button controls are safe, simple and convenient. Compact and rugged, the unit is quiet and economical in operation. Sliding gate with interlocking safety devices starts the cycle. Solenoid valves close the molds. Injection and dwell are controlled by first of three timers on the rear panel. Center timer regulates recharging of heater. The third timer controls the length of the mold close cycle; when time runs out, molds automatically open and parts are ejected. Operator opens safety gate, removes product and then closes gate to begin the next cycle . . . Variable voltage transformers in conjunction with thermostatic units control the temperatures on the two heating zones accurately.



MODEL H-200



MODEL 1



MODEL G-100

Power Operated, Lever Controlled Presses

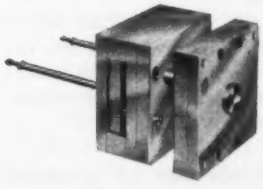
2-oz. or 1-oz. capacity. These low-cost units operate 8 hours for under a dollar and use inexpensive molds. Can easily be set up in twenty minutes by one man.

Manually Operated Press

1-oz. capacity. This press is ideal for smaller jobs, experimental work and technical training.

Plastic Grinder

Grinds up rejects, waste, etc., for re-use. Ruggedly made, designed for easy cleaning.



Mold Bases

Available from stock for all Van Dorn presses.

Write for Bulletins on this Equipment

THE *Van Dorn* IRON WORKS CO.

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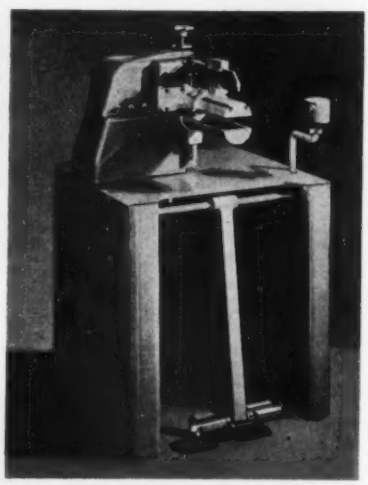
Cable Address: "VANDORN" Cleveland

both five-plate and six-plate build-up. The six-plate type has a plate arrangement identical to the regular standard base, except that leader pins and bushings are reversed and the stripper plate added between the cavity plates. The five-plate type has the same arrangement as the six-plate type save for the omission of the lower cavity plate.

Cylinder maker—Improved efficiency in production of cylinders from plastics sheets is claimed for the 1954 Sheet Plastic Cylinder Maker, introduced by Taber Instrument Corp., 111 Goundry St., N. Tonawanda, N. Y.

The unit is equipped with expanding mandrels having a diameter range of 2½ to 8½ in., and sliding gages. The mandrels and sealing bar,



Taber Instrument's cylinder maker has expanding mandrel for precision fabrication of plastics cylinders

actuated by a food treadle, are timed so that the cylinder is sized to the exact dimension desired just prior to sealing. Mandrel expansion of 1/16 in. brings the cylinder being fabricated up to precision size, and subsequent contraction allows removal of cylinder when treadle is returned to starting position.

The 10- by ½-in. sealing bar is electrically heated by means of a resistance heater equipped with an adjustable thermostat temperature control unit.

Grinder—Production of quantities of circular formed plastics parts is accomplished by the centerless

grinder Model PG-7, offered by the Royal Master Metal Products Co., Riverdale, N.J. The unit has a hydraulically operated ram which provides a wide range of speeds and feeds without need for cams, levers, gears, belts, or similar mechanical devices. An automatic hopper, provided with the unit, permits one operator to run several machines.

Polariscope—Detection of tension, compression, and fracture strains in translucent and transparent plastics is accomplished with a reflecting polariscope produced by R. Fuess, Inc., 39 W. 60th St., New York 23, N.Y.

Operation of the instrument is very simple. The object to be examined is placed on the top ground glass surface of the unit, and any existing strains are immediately reflected in colors in the mirror. The ground glass surface is 12 by 14 inches. For small items, such as lenses, many pieces can be inspected at one time simply by placing them, together with a control piece, on the unit, and then making comparisons.

Milling machine—Specifically designed for electric tracer control, Keller type BG-21 automatic milling machine requires no tracer attachments. The unit has been developed by Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford 1, Conn.

The machine can be used in two ways: 1) duplicate shapes can be cut with the side of an end mill by following a sheet metal templet or side walls of a model with a profiling tracer or 2) three-dimensional shapes can be duplicated by using a three-dimensional tracer to follow a full model in a series of parallel passes with the spacing preset by the operator. The machine can be easily converted from one type of control to the other.

Construction of the equipment is horizontal, allowing chips to fall away by gravity, giving the operator a better view of both the model and the work being cut, and allowing the work-piece to be of large size.

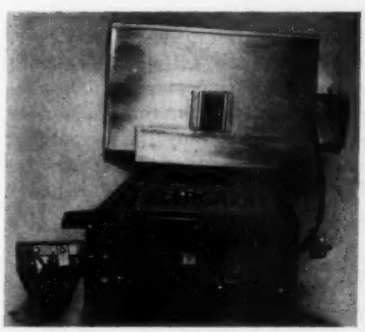
The work table is stationary and the cutter is carried along the work by the spindle head, thus making the movable weight always constant. Both spindle and tracer are adjustable, so that work and model need not be located in exact relation to each other. Lubrication is provided by a central oiling system operated with a single pump. All sliding surfaces have phenolic-to-metal contacts for virtually non-scoring ways. Speed control automatically regulates relative component travel speeds over irregular surfaces to produce constant surface cutting speed.

The model is produced in five sizes, ranging from 4 by 2½ ft. to 10 by 4 ft., plus special spindle models. Traverse up to 250 in. per min. and automatic chip conveyors are standard with the larger models.

Injection accessory—Several improvements have been engineered into the new 500 series of Injecto-Weigh, a unit for weigh-feeding charges of plastics material to injection molding machines, manufactured by Glengarry Equipment Corp., Bay Shore, N. Y.

The new construction of the pivot makes the unit more sensitive than the older model, and thus more accurate.

The storage hopper is mounted on new type shock absorbers to reduce transmission of vibrations to the weighing unit. All adjustments and controls are now mounted on the right-hand side for the greater convenience of the operator. On the left-hand side is a removable plate which permits access to all interior moving parts and to the beam switch. A larger weigh-bucket with a 350-cu. in. capacity makes the unit adaptable to larger molding machines. A new method of gate operation is said to prevent both seizing and jamming difficulties.



Glengarry's series 500 weigh feeding unit is adaptable to use with larger injection molding machines

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Cationic Polymerisation and Related Complexes," edited by P. H. Plesh.

Published by W. Hefer & Sons Ltd., Cambridge, Eng. 166 pages. Price: 20*s*. (ca. $2.80)

The papers which were presented at an informal conference on cationic polymerization at the University College of North Staffordshire and the discussion which followed their delivery are presented in this volume. Some of the topics discussed are: Friedel-Crafts Complexes; interaction between aromatic substances and aluminum and hydrogen halides; complexes between olefins and metal halides; complexes of stannic chloride with water, ethanol, ether, and acetone; the general chemistry of olefin complexes with metallic salts; formation, structure, and reactivity of silver salt complexes; mechanism of the polymerization of styrene by antimonic chloride, using radioactive tracers; and many more.

"Organic Analysis, Vol. I," edited by J. Mitchell, I. M. Kolthoff, E. S. Proskauer, and A. Weissberger.

Published in 1953 by Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N.Y. 473 pages. Price $8.50

Generally speaking, university chemistry courses teaching quantitative analysis deal primarily with inorganic systems or with the elemental analysis of organic compounds. They do not usually enter the field of organic quantitative non-elemental analysis. The bridging of this gap, and the consolidation of current knowledge in this area, is the stated aim of a new series of studies of which the present discussion is the first volume. Subjects covered are the determination of hydroxyl groups, of the alpha-epoxy group, of alkoxyl groups, organo metallic compounds for the determination of active hydrogen, diazomethane for the determination of active hydrogen, determination of carbonyl compounds, of acetals, and of organic sulfur groups, and spectroscopic functional group analysis in the petroleum industry. The book is addressed to the practicing chemist and provides him with a survey of the important analytical methods used in functional group analysis, showing how a combination of chemical and physical techniques is utilized to solve various analysis problems.

"Company Practices in Marketing Research," by Richard D. Crisp.

Published in 1953 by American Management Association, 330 W. 42nd St., New York 36, N.Y. 64 pages. Price $1.75 to members of American Management Association, $2.50 to non-members.

Results of an investigation of the marketing research practices of 128 companies are discussed in this research report. The first part of the study deals with the statistical answers to such questions as what proportion of companies do marketing research, how marketing research is assigned within the organization, what specific activities are performed, which activities are considered most important, which areas of market research are most in need of improvement, etc. The second part offers specific outlines for procedures for successful marketing research activities.

Standards—Revised edition of "Standards Are Your Business" defines the nature of production standards and indicates their value as tools of management. The 24-page booklet outlines the philosophy behind and the objectives of the voluntary standard movement in this country, and cites specific examples of recent savings through standardization effected by leading companies. *American Standards Association, 70 E. 45 St., New York 17, N.Y.*

Polymer-epoxy combination—Preliminary formulas and applications for liquid polymer-epoxy resin combinations are presented in this portfolio containing technical bulletins Nos. 111, 112, and 113, and reprints of articles, several dealing with that subject. The new formulations find use in the potting, adhesive, and coating fields and are said to be characterized by permanent flexibility, high impact resistance, low shrinkage, good wetting properties, and satisfactory low-temperature performance. *Thiokol Chemical Corp., Trenton 7, N. J.*

Appearance research—The work of the organization in doing research in, providing instrumentation for, and rendering technical service on the optical appearance of manufactured products and raw materials is described in this 24-page booklet. Color, gloss, reflectance, opacity, turbidity, and haze are some of the qualities being considered in appearance engineering. *Hunter Associates Lab., 5421 Brier Ridge Rd., Falls Church, Va.*

Glass-reinforced plastics—Uses of resin impregnated glass fibers are outlined in a 32-page booklet titled "Glass Textiles for Industry." It lists 19 industries in which glass textiles find increasing production use, and discusses the various forms in which fibrous glass is employed. Also incorporated are a discussion of the properties and advantages of impregnated fibrous glass and charts illustrating various end uses. *Industrial Products Div., Hess, Goldsmith & Co., Inc., 1400 Broadway, New York 18, N. Y.*

Laminating machinery—Bulletin 1005 describes extrusion laminating equipment available either with manually operated unwind and rewind units or for continuous automatic splicing operations. The extrusion laminating process, a modification of the hot melt coating process in which the coating is applied without solvents, adapts the physical properties of thermoplastic resins to produce a preformed metered film which is then applied to the supporting web while still fluid enough to obtain anchorage. *John Waldron Corp., P. O. Box 791, New Brunswick, N. J.*

Styrene emulsions—Properties and characteristics of four polystyrene emulsions—stable water dispersions of high molecular weight polystyrene—are described in Technical Bulletin C-3-180. Uses of these emulsions in reinforced plastics, water-base coat-

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TYPICAL PROPERTIES

- **Weight loss of castings:**
  After 168 hrs. at 392°F 2-3%
  After 720 hrs. at 392°F ... 13-15%
- **Flexural strength retention of glass cloth laminates:**
  After 168 hrs. at 392°F .. up to 90%
  After 720 hrs. water immersion 92%
- **Shrinkage during curing 5%**
- **ASTM heat distortion point of castings ..... 212-220°F**
- **Electrical properties of castings at 10^9 cycles:**
  Dielectric constant 2.85
  Power factor ..... .00575
  Loss factor ..... .0164

FOR COMPLETE INFORMATION on HETRON resins, send today for technical data sheets listing properties of the liquid resins, cured unfilled resins, and glass cloth laminates. Includes general handling and curing recommendations, and other useful information.

In HETRON, a new family of self-extinguishing resins, you will find *in full measure* all the properties a good fire-resistant polyester should have.

Heat resistance, in particular, is outstanding. Castings aged at 200°C lost only 2% of weight in seven days (as compared with 10% or more for standard non-fire-resistant resins, and up to 20% for ordinary fire-resistant resins).

Glass cloth laminates aged at 200°C for seven days retained up to 90% of their room temperature flexural strength. Fire resistance was virtually unchanged in the same period.

HETRON resins are self-extinguishing even without the use of additives, because they contain 30% chemically-bound chlorine. At the same time, they are clear and stable. Where even higher fire resistance is desired, addition of 5% antimony trioxide results in laminates that will not support a flame for one second, even after five repeated applications of a Bunsen flame.

Transmission of water vapor through HETRON resins is very low, compared to standard resins—so low that it is difficult to measure accurately. Absorption of water is also lower. For these reasons, electrical properties of the resins are much less affected by long exposure to high humidities and elevated temperatures than ordinary polyesters.

Shrinkage-on-cure of less than 5% by volume, and little or no air inhibition, are important advantages of the new resins. Resistance to acids is better than that of standard resins. Heat distortion temperatures are better than with many standard polyesters.

HETRON resins are light-colored, transparent viscous liquids. At present, they are available in drum quantities.

The facilities of our laboratories are available to cooperate with you in the application of HETRON polyester resins.

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9-1307

ings, primers and sealers, paper coatings, and textiles are also covered. In addition, the bulletin presents instructions for the use of these emulsions, with tables listing compatible organic and inorganic pigments. *Chemical Div., Koppers Co., Inc., Pittsburgh 19, Pa.*

Core binder—Product Information Bulletin 84 describes Resimene 970, a urea resin core binder for foundry use. The booklet contains information on production techniques, preparation of mixes, foundry formulations, and trouble shooting in the core room. *Plastics Div., Monsanto Chemical Co., Springfield, Mass.*

Colorant—Two booklets dealing with paste colorants for use with polyester resins provide information of interest to the manufacturer of reinforced plastics. Code 153 presents a brief summary of the characteristics of the firm's line of polyester paste colors, a list of resin suppliers, and price list. The second booklet, "The Use of Paste Colors with Polyester Resins," outlines the reasons for the development of paste colors, the research steps leading to the formulation of a complete range of paste colors, and notes on mixing procedures and shelf life. *Ferro Corp., Color Div., 4150 E. 56 St., Cleveland 5, Ohio.*

Odors—Bulletin 3 contains a summary of available aromatic additives for various plastics applications (bathing accessories, drug and surgical sundries, gloves, toys, novelties, etc.), as well as price lists for drum and can quantities. *Naugatuck Aromatics, Div. of United States Rubber Co., 254 4th Ave., New York 10, N. Y.*

P. V. C. tubing—Uses and properties of fabricated rigid polyvinyl chloride are contained in catalog Hysal 9000. Originally designed as a substitute for steel piping in basic chemical plants, fabricated rigid P. V. C. can also be used in piping, tubing, duct work, work tables, sinks, and other applications. *Houghton Labs., Bush St., Olean, N. Y.*

Paper—"Paper for Industry" outlines the company's activities in the paper field. Among its operations is the production of bleached and unbleached absorbent Krafts, pigment-

ed Krafts, 100% cotton, 50% cotton, 50% wood filler papers, alpha cellulose overlay paper, white and tinted zinc sulphide, titanium dioxide, or Lithopone loaded papers for all types of industrial laminating, and similar products. *Wiggins, Teape & Alex Pirie (Sales) Ltd., Aldgate House, Mansell St., London E. 1, Eng.*

Industrial control—A specialized engineering service for making plant operations automatic is described in a brochure entitled "A Proposal for Management with Vision." The service, said to be the first of its kind, consists of consultation, analysis, design, and construction in the automatic control field. *CDC Control Services, Inc., 400 S. Warminster Rd., Hatboro, Pa.*

Machining handbook—Glass-bonded mica, because of its grain structure and other properties, presents many machining problems. To help overcome them, this booklet, addressed to the machinist, lists the general considerations and gives instructions for specific operations (cutting, breaking, drilling, reaming, counter boring, etc.), so as to avoid any damage which, even though not visible, might impair the performance of the finished product. *Mycalex Corp. of America, 30 Rockefeller Plaza, New York 20, N. Y.*

Industrial hydraulics—The purpose of bulletin 1300-S is to acquaint users with the basic needs of their hydraulic systems so as to achieve most efficient and economical performance. Only industrial machinery is covered. The bulletin contains information on various aspects of hydraulic oils and their selection, operation of machinery under normal and extreme temperature conditions, problems of maintenance, trouble shooting tips, and design hints. *Vickers Inc., 1400 Oakman Blvd., Detroit 32, Mich.*

Glass polyester laminates—Catalog sheet describes the various grades of glass polyester laminates manufactured by the company for application in the electrical, chemical, and decorative fields. *The Dynakon Corp., 9623 Clinton Rd., Cleveland 9, Ohio.*

Pipe and tubing—Available sizes of a line of rigid polyvinyl pipe and

tubing and fittings are listed in this bulletin. Extruded of a vinyl chloride polymer of high molecular weight, the product is said to have good hardness and toughness characteristics as well as high chemical resistance. *Alpha Plastics, Inc., 14 Northfield Rd., West Orange, N. J.*

Polyethylene bottles—Advantages of unbreakable 6½- and 13-gal. polyethylene carboys are pointed out in this 8-page folder. Among them the company claims safety, light weight, lowered shipping costs, ability to handle most corrosives, and reduced replacement costs. Specifications for both jacketed and unjacketed carboys are listed in tabular form. *Plax Corp., W. Hartford, Conn.*

Unwind equipment—A line of unroll units is depicted in Bulletin 1007. Types described are single-center, double-center, shaftless, constant-tension, and fully automatic unrolls. A typical installation diagram is included. *John Waldron Corp., P. O. Box 791, New Brunswick, N. J.*

Molded nylon—The question of whether the use of nylon in the manufacture of an industrial component is practical from a cost point of view is tackled in the booklet "How to Calculate Material Cost for a Nylon Part." Written in technical language and addressed to design engineers, the brochure provides a three-step procedure for determining the material cost of a nylon part. *Nylon Molded Products Corp., Garrettsville, Ohio.*

Coaters—The company's line of sheet coating and gluing machines and auxiliary attachments is described in a four-page folder. Several suggested plant layout diagrams for high-speed coating operations are incorporated. *Potdevin Machine Co., 285 North St., Teterboro, N.J.*

Fire control—A non-technical explanation of the danger of explosion inherent in fuel burning equipment and the protection that is currently available against it is contained in Bulletin CP21. *Combustion Control Corp., 718 Beacon St., Boston 15, Mass.*

Vinyl chloride—Various aspects of Geon polyvinyl materials are covered in several booklets and folders. Service Bulletin G-8 deals with compounding of Geon resins 101 and 101-EP, covering plasticizers, stabilizers, colorants, fillers, and lubricants, and containing a section on the development of some typical formulations. "Geon Polyvinyl Materials" outlines in tabular form suggested compounding methods, processing methods, finishing operations, and optional compounding ingredients for polyvinyl compounds. "Properties of Geon Latices" also lists in tabular form latex properties, 4-mil cast film properties, and 1-mil latex-coated paper properties for nine Geon latices. Service Bulletin G-6 gives physical, chemical, and electrical properties of Geon resin 404, as well as information on its processing and applications. "Packaging Problems Solved with Geon" relates eight case histories in which the use of Geon resins contributed to the solution of various packaging difficulties. "Properties and Uses of Geon Polyvinyl Materials" provides the overall picture on properties and uses of all Geon compounds with a minimum of technical detail. *B. F. Goodrich Chemical Co., 2060 E. 9th St., Cleveland 15, Ohio.*

Boxes—This catalog lists the company's line of rigid polystyrene boxes from stock molds. A variety of shapes, sizes, and closures is offerred. *Bradley Industries, 1650-58 N. Damen Ave., Chicago 47, Ill.*

Punch and die maintenance—Care, handling, cleaning, and storage hints for proper maintenance of single and rotary punches and dies used in tablet presses are given in Bulletin 611. Additional topics discussed are the problems of wear, lubrication, and overloading. A list of 50 do's and don'ts at the end of the booklet summarizes the maintenance tips in concise form. *F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*

Cellulosics—The new edition of "Cellulose Acetate," in addition to presenting the latest basic technical information about the compound, has been brought up-to-date to include data on new solvents, plasticizers, and resins. The section on uses has been expanded to present a discussion of acetate specialty lacquers, including starting formulas for clear and pigmented outdoor lacquers, heat-resistant paper lacquer, greaseproof wallpaper lacquer, plastics

coatings, and dipping lacquers. *Hercules Powder Co., Inc., Wilmington, Del.*

Sealer—Engineering data for EC-1120-PC, a dielectric sealer, are published in this bulletin. The sealer, originally formulated for the aircraft industry, is a two-part synthetic rubber material with high dielectric properties and good moisture and vibration resistance. Data include weight per gallon, specific gravity, minimum time of working life, hardness, operational cure time, etc. Notes on applications, mixing procedures, storage, and cleaning are also given. *The Adhesives and Coatings Div., Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2, Mich.*

Radioactive reagents—Bulletin FS-231 provides information on the development, applications, and instrumentation of 25 compounds made radioactive by the addition of carbon-14. These radioactive compounds are supplied in 400-mg. vials, each with a total radiation of 1 microcurie —said to be analytically useful yet safe. Some of the applications are in the determination of solubilities, distribution coefficients, diffusion and absorption phenomena, and in the solution of similar analytical problems. *Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.*

Industrial chemicals—The complete line of the company's chemicals for industrial, agricultural, and pharmaceutical applications is detailed in a 36-page booklet "Michigan Chemical." Fifty-three compounds are listed, with specifications, uses, shipping regulations, R. R. classification, and standard container information given for each. *Michigan Chemical Corp., St. Louis, Mich.*

Flow measurement—Operation of variable area fluid flow rate meter is described in Catalog 10-A-10. Also outlined are the theoretical and mathematical principles underlying its functioning, as well as the advantages and disadvantages resulting from its use. Among the former are wide metering range, low and uniform pressure losses, immunity to effects of upstream piping, immunity to viscosity changes, self-compensation for density changes, self-cleaning tendency, minimized effect of

pulsations, and entrained condensible vapor elimination. The catalog also lists a number of Flowrator meter designs for various applications. *Fischer & Porter Co., Hatboro, Pa.*

Architectural plastics—The services offered by the company in the supply, design, and application of plastics for architectural purposes are outlined in a four-page folder. *Plasti-Products Co., 1541 McKinley Ct., Eugene, Ore.*

Tablet machines—A line of single punch and rotary tabletting presses for compacting pharmaceuticals and powdered metals, making plastics preforms, and performing similar operations is presented in Catalog 801. Suggested applications for which each model is best adapted and details of mechanical design are provided. The catalog also contains a section dealing with the punches and dies available for use with these presses. *F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*

Plasticizers—Technical data on a line of plasticizers—dioctyl phthalate, dioctyl adipate, dioctyl azelate, dioctyl sebacate, and dioctyl diglycolate—are presented in a 30-page booklet entitled "Plasticizers, Their Properties and Uses." A section on techniques for plasticizer evaluation in vinyl resin compounds is also included. *Canadian Resins and Chemicals Ltd., 600 Dorchester St., W., Montreal 2, Que., Canada.*

Catalog—Laminated plastics sheets, tubes, rods, spiral tubing, Teflon sheets and tapes, silicone tapes, Celoron molded industrial plastics, and other products offered by the company are described in a 12-page catalog GF-54. Technical data are included. *Continental-Diamond Fibre Co., Newark, Del.*

Thermoplastic resins—A series of high styrene copolymer resins, said to exhibit both high impact strength and high heat distortion and to be processable on conventional rubber or plastics equipment, is described in 3 technical bulletins. Techni-Guide PT-100-1 provides data on physical properties of Plio-Tuf G75G, compounding, processing, postforming, and contains tables summarizing information on heat stability, shrinkage, service tests, exposure tests, staining characteristics, and chemical resistances. Application notes and a list of suppliers is also included. Techni-Guide PT-100-2 lists the corresponding information for Plio-Tuf G85C, similar to G75C, but designed for applications requiring high heat distortion and superior strength, and also presents data on average physical properties of various blends of these two resins. Techni-Guide PT-100-3 outlines various properties of blends of Plio-Tuf G85C and natural and synthetic rubbers. *The Goodyear Tire & Rubber Co., Inc., Akron 16, Ohio.*

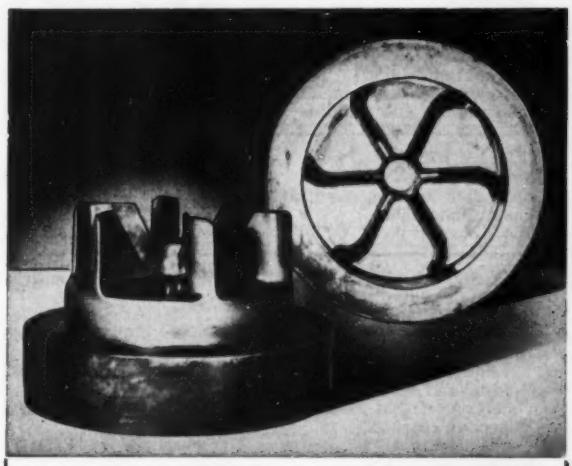
Dust Removal—Vertical rotor type dust and fume eliminator is described in a 4-page booklet. The unit operates by drawing dust-laden air into a chamber where, undergoing a cyclonic motion, the dust is removed when it strikes the surface of water in a tank contained in the unit. Excess moisture of air is eliminated by extractors. Exhausted air can be either returned to the working area, or vented to the atmosphere. *Schmieg Industries Inc., P.O. Box 4701, Detroit 34, Mich.*

Q. What process means *uniformity* in glass yarns and fabrics for superior quality glass-plastics products?

A. It's Electronic-Extrusion—the advanced process for glass fiber manufacture—developed, patented and used exclusively by Glass Fibers Inc.

This 8-page booklet will give you the "what" and the "why" on VITRON Glass Fiber Yarn from raw glass batch to finished package. The new glass fiber nomenclature, property tables, synthetic fiber comparison charts are all here too.

Write now for your copy. Glass Fibers Inc., Dept. PRM-35, 1810 Madison Avenue, Toledo 2, Ohio.



Hob diameter	8½"
Blade height	2.813"
Blade thickness (top)	.062"
Blade thickness (bottom)	.093"
Number of castings required	4
Number of castings supplied	4

Customer: Haas Corporation
Mendon, Michigan

PROCESS MOLD CO.

High Pressure Cast Beryllium Copper Castings

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Want to Know About the Latest BRITISH PLASTICS Developments?

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. . . in injection molding
. . . in extruding
. . . in fabricating
. . . in materials

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n. first 6 mos. 1953*	*Total sales first 6 mos. 1953*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	8,384,558	8,249,461
0.003 gage and over	6,836,628	6,541,671
All other sheets, rods and tubes	3,078,242	2,695,726
Molding, extrusion materials	39,187,097	38,659,104
Nitrocellulose:		
Sheets	3,631,031	3,037,750
Rods and tubes	289,630	397,773
Other cellulose plastics[b]	3,655,509	3,686,046
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	40,539,815	27,710,080
Adhesive	24,906,665	22,889,251
Molding and casting materials[a]	119,505,489	115,446,318
Protective coatings (modified and unmodified except by rosin)	16,245,344	14,520,136
Miscellaneous uses	42,109,903	47,078,271
UREA AND MELAMINE RESINS:		
Adhesives	42,080,132	40,891,409
Textile-treating resins	16,527,194	16,150,742
Paper-treating resins	11,364,985	11,129,685
Protective coatings, modified and unmodified	15,237,681	11,403,038
Miscellaneous uses, including laminating and molding[c]	39,800,836	40,585,730
STYRENE RESINS:		
Molding materials[a]	174,407,688	157,363,366
Protective coatings, modified and unmodified	43,602,973	43,077,268
Miscellaneous uses	44,286,695	39,431,185
VINYL RESINS:[d] Total	270,224,536	252,406,700
Sheeting and film (resin content)[e]		81,017,044
Adhesives (resin content)		11,309,660
Textile and paper-treating resins (resin content)[f]		26,614,805
Molding and extrusion materials (resin content)		86,520,840
Protective coatings (resin content)		14,335,477
Miscellaneous uses (resin content)		18,837,358
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	90,598,654	88,578,247
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS		
Molding materials[a,g]	67,971,049	63,748,210
Protective coatings[h]	4,072,38[illegible]	2,484,317
All other uses[i]	67,597,75[illegible]	67,285,911

* Dry basis is designated unless otherwise specified. [a] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total produc-

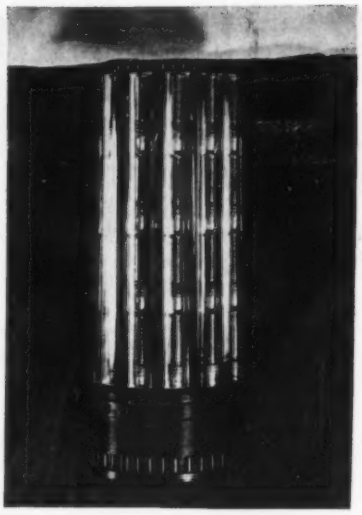
Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR MAY AND JUNE 1953
by U. S. Tariff Commission

May 1953		*June 1953*	
Production	*Sales*	*Production*	*Sales*
1,495,989	1,351,845	1,628,193	1,631,855
1,222,097	1,222,577	1,307,714	1,234,292
524,576	417,117	654,192	559,914
6,072,575	6,224,810	6,770,196	6,440,381
609,422	460,824	631,649	509,294
52,796	52,327	59,408	82,270
682,904	641,713	594,428	705,885
6,562,916	4,292,923	6,547,117	4,530,903
4,020,919	3,650,729	3,859,055	3,540,015
20,795,578	18,339,756	20,653,425	18,961,154
2,814,046	2,451,878	2,658,489	2,317,941
6,919,876	5,800,661	6,573,452	6,029,926
7,732,395	7,161,507	7,354,419	7,126,146
2,536,377	2,338,327	2,369,882	2,046,446
2,314,089	1,786,413	1,777,847	1,645,790
2,529,318	1,949,174	2,401,889	1,764,464
7,273,418	6,593,995	7,939,870	6,337,718
32,272,782	25,676,184	29,207,279	22,924,764
8,065,555	7,320,889	6,768,988	5,931,376
7,101,150	6,629,352	6,805,401	5,877,271
46,789,782	39,433,204	44,884,260	39,686,184
	14,765,848		14,704,717
	1,762,453		1,760,807
	4,126,310		4,174,857
	13,509,487		13,439,635
	2,185,478		2,331,321
	3,083,628		3,274,847
13,450,829	14,086,805	16,244,488	16,001,015
11,513,219	10,202,046	11,238,849	11,035,287
680,706	366,987	675,057	383,411
11,690,629	11,139,951	12,631,058	12,582,505

tion are given. * Prior to January 1951, statistics were given on the basis of total weight. [z] Includes data for spreader and calendering-type resins. [x] Includes data for acrylic, polyethylene, nylon, and others. [b] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.



Molded butyrate rifle shell dispenser clips conveniently on trouser belt

Shell Dispenser

A SAFE and convenient way for hunter or marksman to carry and dispense .22 caliber rifle shells is provided by a clip-on cartridge holder molded of butyrate. The handy container, a product of Durden-Fraley Co., Atlanta, Ga., is designed to stock one full box of any size .22 caliber cartridge and to dispense them one at a time as they are needed.

With the exception of a metal belt clip and metal springs, screws, and bearings, the entire unit—top plate, body, and four bottom disks—is molded of tough cellulose acetate butyrate by St. Louis Plastic Moulding Co., St. Louis, Mo.

To load the dispenser, the opaque black top plate is turned so that the molded-in intake spout in the plate lines up, one by one, with the cylinders in the transparent body. Cartridges are dropped nose down through the spout until each cylinder is fully loaded.

To dispense cartridges, the serrated bottom part is turned to line up the dispensing spout successively with the cartridge-loaded cylinders. With each movement, another shell drops out.

By changing the relative positions of two of the bottom disks, the dispenser can be adjusted to accommodate .22 caliber long rifle cartridges or longs or shorts.

Vinyl Spray

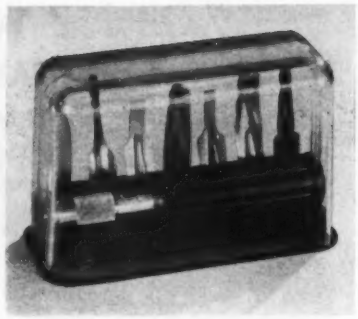
APPLICATIONS for sprayed-on vinyl (see "New Jobs for Sprayed-On Plastics," MODERN PLASTICS *31*, 93, Oct. 1953) continue to grow in versatility as well as in volume. Latest addition to the long list of industrial and commercial uses is the restoration of centuries-old art masterpieces by spraying them with liquid vinyl.

At the Museum of Fine Arts, Boston, Mass., a liquid Geon vinyl latex is sprayed on the art work to prevent further decay and discoloration, to protect the colors, and to seal the paper fibers from the effects of dirt, insects, gases, bacteria, oxidation, and atmospheric conditions.

The sprayed-on vinyl restoration system has already been successfully used for works ranging from old maps to colored prints. One particularly outstanding job was done in the restoration of a badly decayed 15th century woodcut mounted on a wooden panel. The cut, thoroughly cleaned with alcohol, was first photographed in black and white and in color. An outline drawing of the cut was then made on a linen paper that was to serve as the final backing. Next, the print, which had been loosened by warm water, was stripped in pieces off the panel and remounted over the outline on the linen backing. After being thoroughly dried, the new stripped-in picture was sprayed with vinyl—and the restoration was complete.

CREDITS—*Geon vinyl supplied by B. F. Goodrich Chemical Co., Cleveland, Ohio.*

Vinyl is sprayed on old map to protect the colors and seal the paper fibers



All-styrene package for tools consists of transparent cover, black base

Tool Housing

FOLLOWING the basic principle of modern packaging—full visibility—X-acto Crescent Products Co., Inc., New York, N.Y., now offers a series of tool sets housed in a 2-piece styrene case consisting of a transparent crystal styrene cover and an opaque molded styrene base. Both parts of the case are injection molded by The Campro Co., Canton, Ohio, in a 2-cavity mold on a 6-oz. machine.

The glossy black base, which is available in three different types to fit three different sets of tools, is molded with a long horizontal depression into which an adjustable handle nests and with a series of slots that accommodate the various blades, routers, gougers, etc. in each of the tool sets. The high-domed transparent cover, ribbed at either end for greater strength, is designed to slide easily on and off the base of the housing.

This new method of packaging in plastics contributes much to the sales appeal, utility, and safety features of the tool set. As an effective, eye-appealing counter or window display unit, the new package protects the tools from dust and moisture and enables the customer to quickly spot the particular tools he desires. After purchase, the styrene case provides a durable, convenient storage unit for the home handyman's workbench or hobby table. By keeping the blades neatly and visibly in their proper place, the case eliminates the danger of cut hands which usually result from "fishing" through cluttered-up tool boxes in search of a particular tool.

Coveralls

COVERALLS, woven of new Vinyon-N vinyl chloride-acrylonitrile copolymer threads, are designed for the wearer's comfort as well as for his protection.

Because of the unusual properties of the copolymer fabric, the gray coveralls, which are manufactured by Filtration Fabrics Div., Filtration Engineers, Inc., Newark, N.J., are not affected by concentrated mineral acids and alkalis and have a high resistance to a wide variety of inorganic acids, bases, and salts. The material also resists the temperatures and strong reagents used by industrial laundries and is immune to bacteria and mildew. Pockets and thread of the coveralls are of the same chemical-resistant fiber for fuller protection.

Although tough and strong, the outfit is remarkably light in weight, cool, flexible, and smooth when worn next to the skin.

To complement the strength of the plastics fabric, all strain points of the outfit are bar-tacked; the full rolled seams are double stitched with Vinyon-N threads to prevent unraveling; and the pockets—two breast pockets, pencil pocket, two side pockets, two hip pockets, and a tool pocket—are also tacked in place with the tough fiber.

Protective coverall, woven of a copolymer thread, will resist most chemicals

"Hot Rod" Auto

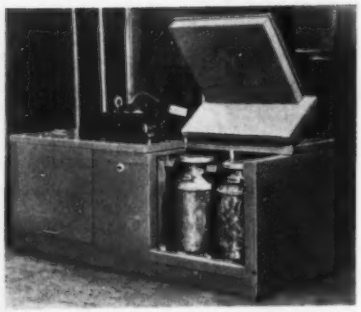
ONE of cellulose acetate's major attributes—its rugged toughness—is used to advantage in a clever new toy molded and distributed by Imperial Crown Toy Corp., Brooklyn, N.Y.

Called the "Hot Rod," this model of a stripped-down automobile chassis is designed to be deliberately wrecked and then re-assembled—thereby satisfying Junior's mechanical as well as his destructive urges. The auto is simply rolled against wall, chair, or table leg. Upon bumper contact, a spring mechanism on the chassis is touched off, sending the four component parts of the unit flying off in all directions. Once the spring platform is snapped down again, however, the four interlocking parts are fit easily back into place—ready to give another performance.

Upon bumper contact, parts of molded acetate toy auto fly off in all directions

Since the five separate parts of the Hot Rod—stripped-down motor, dashboard with steering wheel, driver's seat, rear trunk section, and undercarriage—must dovetail perfectly to facilitate this reassembly operation, each must be held to very close tolerances while being molded.

The toy is injection molded of Celanese acetate on a 16-oz. HPM machine. A 16-cavity cast steel family mold produces two complete autos with each 40-sec. cycle. Component parts and chassis of the "Hot Rod" are in contrasting bright colors.



Slabs of styrene foam are used as insulation in a new line of milk coolers

Foam Insulation

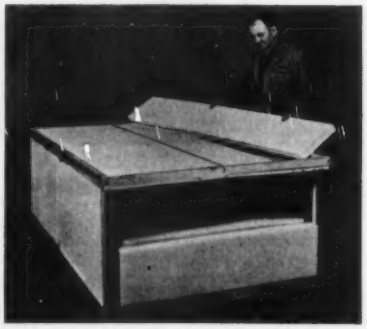
SINCE styrene foam is composed of millions of tiny individually-sealed cells, the dead air space that is thus provided offers exceptionally good insulation for long periods of time. Recognizing this fact, Babson Bros. Co. of N.Y., Syracuse, N.Y., has installed Styrofoam insulation in each of the units that make up their line of milk coolers.

In addition to its value as insulation, the foam possesses excellent water vapor resistance and has low thermal conductivity. Added to these properties, the foam is very light—weighing only about 2 oz. per board ft.—is readily cut to fit, and is easily installed with a minimum of labor costs.

In the construction of the Babson milk cooler, for example, the installation is accomplished by simply fitting large rigid boards of foam snugly—and permanently—in place between the inner and outer sheet steel walls of the cabinet.

CREDITS—*Styrofoam by The Dow Chemical Co., Midland, Mich.*

The large, lightweight, rigid boards of styrene foam can be easily installed



Boon to Builders

(*Continued from pp. 87-92*)

fumes, salt water, ethyl alcohol, etc. It is rotproof, mildewproof, and is not subject to attack by fungi or vermin and similar pests.

Fire Resistance

The standard grades of reinforced plastics glazing material are not fireproof—a disadvantage which has held back their advance in areas where building codes call for nonflammability.

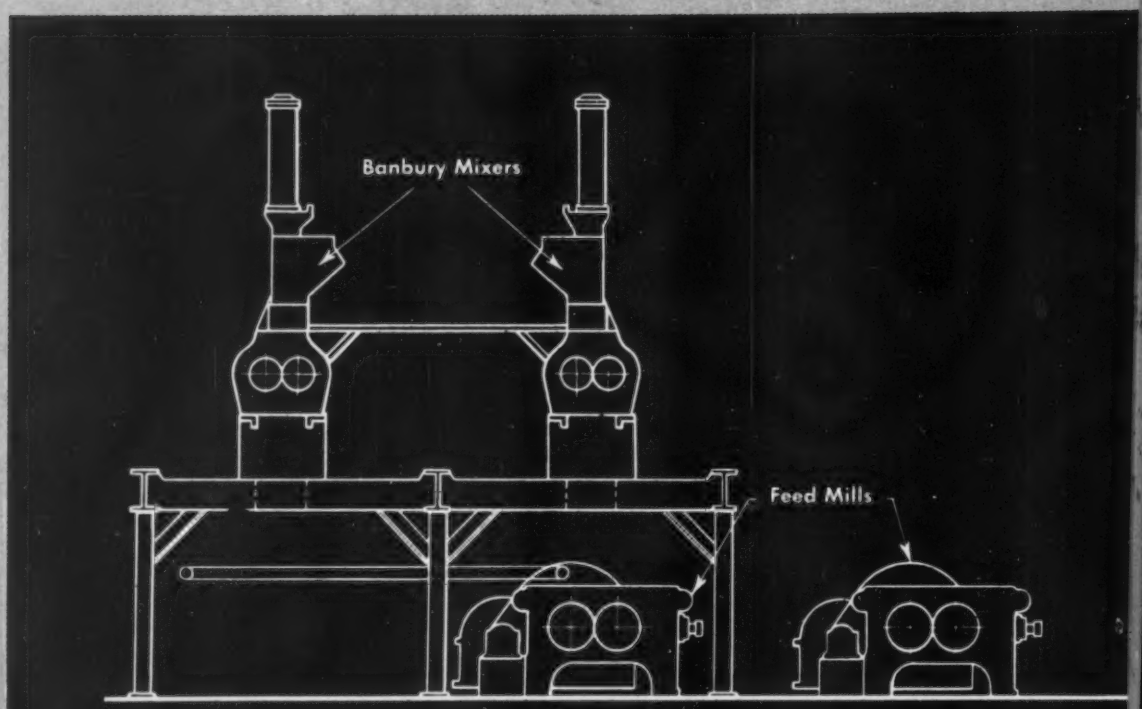
Burning particles, however, falling on the surface of the sheet are not apt to ignite it. In one series of tests conducted by a leading manufacturer, the bottom surface of the sheet, when subjected to heat, did not ignite until a temperature of 835° F. had been reached. At no time, subsequent to the ignition of the bottom surface, did the top surface of the specimen ignite.

As a solution to the problem, a great deal of research is being conducted on the utilization of self-extinguishing resins.

Such self-extinguishing resins have been available for some time, but weathering qualities, particularly color stability under exposure, have not been too acceptable. Recently, however, Alsynite Corp., San Diego, Calif., one of the pioneers in the industry, announced a self-extinguishing, fire-resistant sheet, with adequate weather resistance and suitable for highly-specialized installations in critical fire areas. Although such material is currently available only at a premium price, the industry is confident that within a few years, the price of fire-resistant glazing sheets will have been sufficiently lowered.

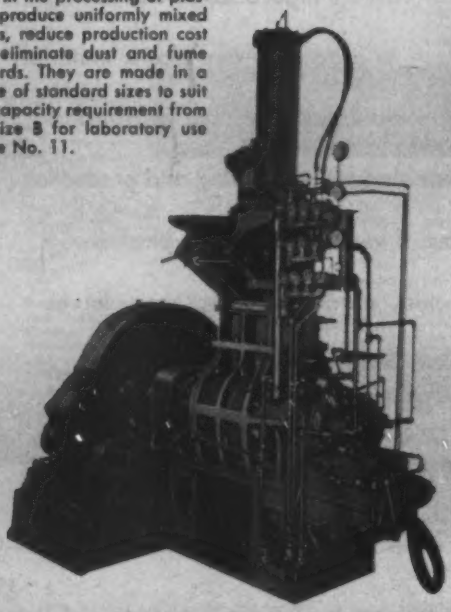
Applications

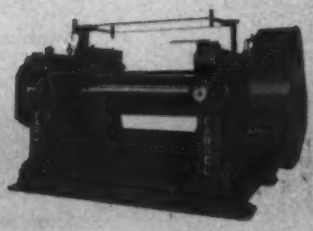
Of the three major market areas for reinforced plastics glazing materials—commercial, residential, and industrial—the latter now absorbs more than half of the glazing sheet produced annually. In terms of the 16 million sq. ft., which it is predicted will be sold this year, the industrial market therefore represents an outlet for well over 8 million sq. ft. of the sheet. The two major industrial applications are skylights and sidewalls, where the material can be easily and economically installed



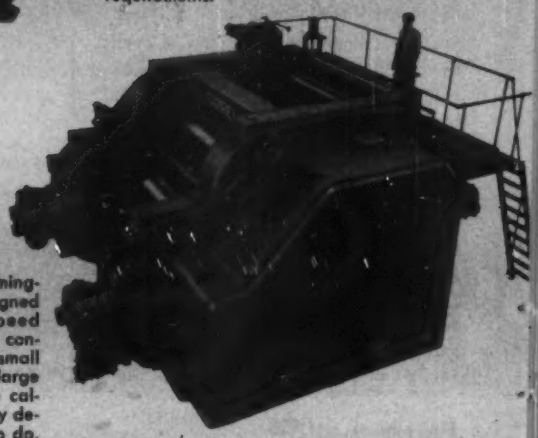
BLUEPRINT FOR ECONOMICAL

BANBURY MIXERS, widely used in the processing of plastics, produce uniformly mixed stocks, reduce production cost and eliminate dust and fume hazards. They are made in a range of standard sizes to suit any capacity requirement from the size B for laboratory use to the No. 11.

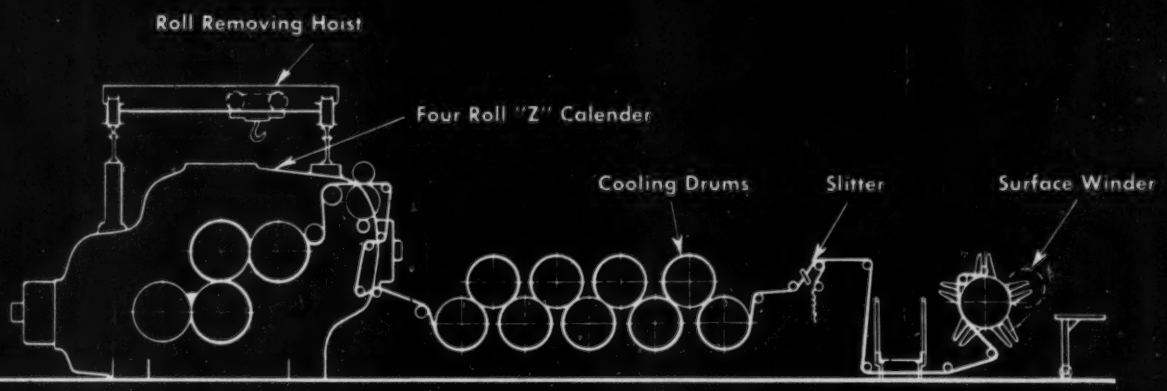




MILLS — Farrel-Birmingham mills provide close temperature control and accurate gauge when these are required. They are available in a complete range of sizes, from 6" x 13" for the laboratory up to 28" x 84" for the factory. Variations in design are available for special requirements.



CALENDERS — Farrel-Birmingham calenders are designed for continuous high-speed operation and accurate control of gauge. From the small laboratory units to the large production machines, the calender is equipped in every detail for the work it has to do.



FILM AND SHEET PRODUCTION

Continuous flow of product is vital to successful production of plastic film and sheet. In calendering, especially once proper running temperature has been reached and the gauge set, interruption of scheduled production is costly.

The processing setup blueprinted here is one of a number developed by Farrel-Birmingham engineers working with plastics manufacturers, to synchronize the progressive steps in the production of plastic film, sheet and coatings. Specially designed for light-gauge film production, it consists of two 3A Banbury mixers, two high-temperature mills, a 4-roll "Z" calender, cooling drums and windup. The calender is designed for production speeds up to 150 yards per minute and is capable of absorbing the continuous output of the two Banbury mixers.

Because each machine is matched in capacity with the other units in the production line, production without interruption caused by the "choking" or "starving" of a unit is assured.

Matched production units have given such satisfactory service that they have become generally accepted as standard equipment for film, sheet and coatings production. For individual requirements, demanding greater or lesser output, larger or smaller machines with matched capacities are available.

A Farrel-Birmingham engineer will be glad to help you select individual machines or combination units best suited for your specific requirements.

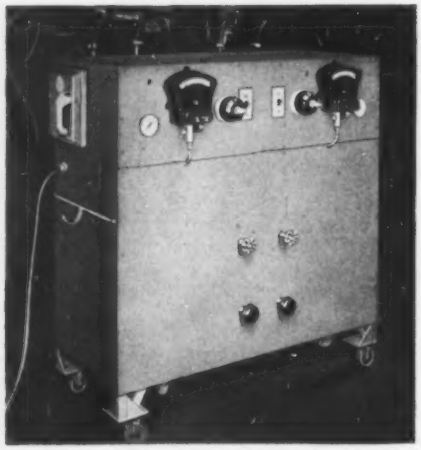
FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

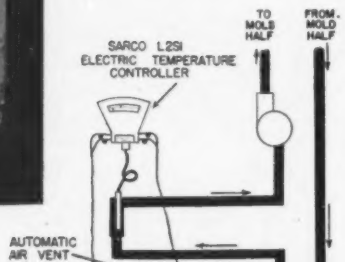
Farrel-Birmingham®

FB-870

NEW
Mold Temperature Controller offers you many Exclusive Features



Sketch below shows one of the two water systems through which the Sarcotrol *Unit provides independent temperature control for each mold half.*



by nesting them with corrugated metal frames.

Commercial applications, which include store fronts, office partitions, luminous ceilings, displays, and showcases, account for 15% of the sales in reinforced plastics glazing materials, and residential applications—ranging from canopies and awnings, backbars, shower doors, and patio roofs to car ports and shelved partitions—account for the remaining 35 percent.

Since the specific applications in each of these distinct market areas requires different strength characteristics, load-bearing characteristics, etc., nearly all of the manufacturers make their material available in different values of thicknesses and weights.

The figures for size, weight, and thickness which are listed in the tear-out Source Chart are therefore simply for standard sheets. Variations are available from manufacturers in all dimensions on a custom order basis.

To some extent, the strength of the sheet is regulated by the glass content per sq. ft.—the more, the

by nesting them with corrugated metal frames.

Commercial applications, which include store fronts, office partitions, luminous ceilings, displays, and showcases, account for 15% of the sales in reinforced plastics glazing materials, and residential applications—ranging from canopies and awnings, backbars, shower doors, and patio roofs to car ports and shelved partitions—account for the remaining 35 percent.

Since the specific applications in each of these distinct market areas requires different strength characteristics, load-bearing characteristics, etc., nearly all of the manufacturers make their material available in different values of thicknesses and weights.

The figures for size, weight, and thickness which are listed in the tear-out Source Chart are therefore simply for standard sheets. Variations are available from manufacturers in all dimensions on a custom order basis.

To some extent, the strength of the sheet is regulated by the glass content per sq. ft.—the more, the stronger. Plexolite Sales Co., Los Angeles, Calif., for example, markets four separate types of sheet—an "L" type, for decorative applications, which contains 1½ oz. of glass per sq. ft.; an "M" type, for store fronts, windows, walls, patio roofs, etc., which contains 2 oz. per sq. ft.; an "H" type for office partitions and structural applications, which contains 3 oz. per sq. ft.; and an "EH" type for extra heavy-duty uses, containing 4 oz. per sq. foot.

Residential Applications

In the second largest market area for reinforced plastics glazing material, the residential market, there are two specific applications which are currently being promoted by the manufacturers.

First are the attractive durable reinforced plastics awnings. This year, it is estimated that some 2 million sq. ft. of reinforced plastics sheet will go into this application and, on the basis of sales by such companies as Ray-O-Lite Corp. of America, Atlanta, Ga., and Stahl Industries, Inc., Youngstown, Ohio, this figure should go over the 8 million mark by 1957. The awnings have many advantages, as compared to those of conventional materials. They are translucent,

thereby providing a soft shade, and cannot rust, rot, or weather. The awnings can be made to any specification within a given size limit. Ray-O-Lite, for example, offers individual sheets in widths up to 33½ in. and lengths to 12 feet.

Along the same lines, Russell Reinforced Plastics Corp., Lindenhurst, L. I., has gone one step further by producing a hurricane shutter of Laminac polyester resin impregnated fibrous glass. When rolled up, the shutter serves as an awning; when rolled down, it doubles as an impactproof covering that protects the entire opening from damage by severe storms.

The second major promotion theme being planned for next year is in the "do-it-yourself" applications, described earlier in this article, of patio roofs, windows, walls, partitions, sun and wind shelters, cupboard doors, pool enclosures, etc.

Reinforced plastics glazing material can be machined using practically any conventional method. It can be cut with a metal cutting hand or power saw, shears, or abrasive power tool; it can be nailed; and it can be bolted, punched, or drilled. The installation of a patio roof, for example, on a supporting structure of rafters would require less time and half the cost than if conventional materials were to be used. A minimum of framing and no expensive labor or special tools are required.

To assist in the installation, various accessories are available from manufacturers. Some produce their own, as the tear-out Source Chart indicates, while others make standard accessories available through their distributors.

Included among these accessories are: horizontal closures for sealing across the corrugations at the end of panels; vertical closures for sealing the side lap of panel or along the end of the corrugation; sidewall flashing for use where panel meet sidewall in new construction; contour molding for use at top and bottom of panel; ridge rolls for use on peaked roofs; and lead-headed nails with neoprene washers to insure weather tightness.

Specialized Applications

Characteristic of the reinforced plastics glazing industry is the variety of new uses that are continually being developed for the material;

one such new application, for which a future large volume use is being predicted, is in greenhouses. In a 4-year test conducted at the Botanic Gardens in Santa Barbara, Calif., reinforced plastics glazing material proved exceptionally successful as a covering for plants. In addition to the ease with which it can be installed and maintained, the material diffuses transmitted light, yet admits the rays that stimulate plant growth.

In line with these new uses that are being regularly devised both by manufacturers and end users, new innovations in the material itself are also being researched. One company, Parker Mfg. Co., San Diego, Calif., adds continuous filament reinforcement, running lengthwise with the corrugations, to the normal complement of glass mat. Because of these additional rovings, greater strength is obtained.

Another company, Corrulux Div., Libbey-Owens-Ford Glass Co., Houston, Tex., has devised a unique new material, Woven Corrulux. The glass reinforcement used is especially woven to simulate the textured pattern of a woven fabric. The material is available in a bold weave that accents the texture, and in a fine weave designed for lighting effects. It is suitable for use as a room divider, bath enclosure, or in displays.

Corrulux has also announced another new product, weighing about ¼ lb./sq. foot. It is said to be flexible enough to bend parallel to the corrugation, but rigid enough to be used for ceiling light fixtures on a 4-ft. span.

Experimentation is also being conducted by the manufacturers of reinforced plastics glazing material on new surface textures and decorative finishes. Currently, most glazing sheets are made either with a smooth surface or with a crinkled finish obtained by substituting a sheet of cellulose acetate for the cellophane used in the manufacturing process.

Acrylics

Acrylic, the older of the two plastics glazing materials, has already proved itself in a variety of architectural and lighting applications. The material offers almost unlimited diversification, ranging from industrial glazing to display model forms.

Acrylic structural and glazing material is a shatterproof, translucent sheet, which, despite its light

weight has exceptional structural strength. It may be struck hard blows without breaking and can withstand shocks which would shatter ordinary glass.

In its colorless form, it is almost equal to optical glass in clarity, boasting a light transmission value of over 92% that of glass. It is also available in a wide range of colors, both transparent and translucent, which provide an excellent diffusion of light.

The material may be readily machined, sawed, or drilled like wood or soft materials. It is resistant to age, most chemicals, and to prolonged exposure to weather and sun; it is unaffected by automotive gasoline, mineral oils, mineral acids, battery solutions, and strong alkalis; and it can be formed at a temperature of 300°F. to almost any desired corrugation or shape, using low-cost wood or plaster dies.

Acrylic Glazing Applications

Acrylic glazing materials service practically the same three market areas as the reinforced plastics glazing material. They are used primarily for glazing in industrial construction or wherever glass breakage has become an annoying and expensive maintenance cost and personnel safety demands a material that can withstand high impact. Since its corrugations match that of metal, it can be easily nested or lapped in with a corrugated metal roof or wall as part of the unit itself. This eliminates the need for additional installation accessories, such as metal sashes, which might tend to deteriorate because of the chemical fumes found in many industrial plants. From the optical standpoint, it diffuses light, eliminates much of the objectionable window glare, and absorbs and reflects a substantial amount of solar heat, assuring a cooler interior.

Because of this excellent diffusion characteristic, acrylic glazing material is also in large-volume use for luminous ceilings and diffusing panels in commercial, industrial, and residential areas. One major motor car manufacturer has recently installed approximately 20,000 sq. ft. of acrylic as luminous ceilings.

As the backlighted facade of a building, as the face of an interior lighted sign, or as a diffusing panel in large area lighting, corrugated or flat acrylic glazing sheet becomes a

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luminous surface on which there is no shadow or outline of the lighting sources. Flat sheets are ideal for shielding any conventional panel type of lighting. One company, Eastern Industrial Service, Inc., Cambridge, Mass., by adding special ingredients during the extrusion process, has produced an acrylic sheet that is claimed to deflect up to 80% of the solar rays and to filter out up to 95% of the ultra-violet rays.

As partitions, the acrylic sheet provides a lightweight, breakage-resistant, easily cleaned unit of subdued beauty; as overhead screens, the acrylic sheet diffuses daylight, is easy to install, and adds an interesting decorative pattern to a room; and in signs, the sheets are safe, easy to handle, easy to cut and form, and provide fascinating possibilities for all types of display work.

Acrylic structural panels and glazing sheets are available in several different thicknesses (see tear-out Source Chart) each designed to fit in with specific applications and strength requirements. Rohm and Haas lists the following differences in the impact strength of three of their standard thicknesses of Plexiglas; a ⅛ in. thick Plexiglas sheet has six times greater resistance to impact breakage than double strength window glass; a 3/16 in. thick sheet has ten times greater resistance; and a ¼ in. thick sheet has 17 times greater resistance.

The Future

The possibilities that the translucent plastics glazing and structural sheets open in modern home and factory design cannot be overlooked. In the hands of a creative architect or industrial engineer, the materials can be made to work wonders! They answer—and answer fully—the problem of what to use for applications where structural strength, light with privacy, and beauty are desired.

To meet the demands of modern living and modern industry, tomorrow's home and tomorrow's factory will come to depend more and more upon acrylic and reinforced plastics glazing and structural materials.

To the manufacturers listed in the tear-out Source Chart our many thanks for their considerable help in the preparation of this article. Our thanks also to their raw material suppliers who contributed in many ways to the data collected.—END

Plasticizers

(*Continued from pp. 93-97*)

between 70° C. for the more soluble plasticizers up to 105° C. for the less soluble. The time required for dry blending is dependent also on the size of the blender.

Dry blends of formulations for clear extrusions are not as dry and sandy as formulations containing opaque stabilizers and fillers. They are "fluffy" or rubbery in feeling but feed well from the hopper. The plasticizer content of the clear dry blends is limited to around 75 p.h.r. (parts per hundred parts of resin) while in opaque or filled formulation the plasticizer may go to 125 p.h.r.

Extruders

There are many makes of extruders on the market, all of which are or can be made mechanically efficient. Factors which influence successful extrusion are:

1) Proper ratio of length to diameter of worm; 2) worm design; 3) temperature control; 4) die and breaker plate design; and 5) feeding techniques.

It is impossible to outline an extruder design which is applicable for all compounds, for all extruder sizes, or for all types of extruded products.

Extrusion equipment for working dry blend compound differs from that for pelletized compound. Techniques and equipment for extruding the latter are well established. Certain suggestions, however, might be made which would prove useful in determining the optimum design and conditions for the extrusion of dry blends.

The suggested length to diameter ratio of the worm is in the order of 15 to 20 : 1. The length of the screw would be determined by the strength needed to withstand the strain of extruding.

The worm should be designed with a uniform pitch, decreasing depth, in which a compression ratio of 3½ to 4½:1 is achieved. The depth at the head end should be shallow by comparison to those suggested for handling granular compounds.

In extruding dry blends, the temperature of the compound leaving the die is invariably higher than with granular compounds. It is essential that adequate heat controls

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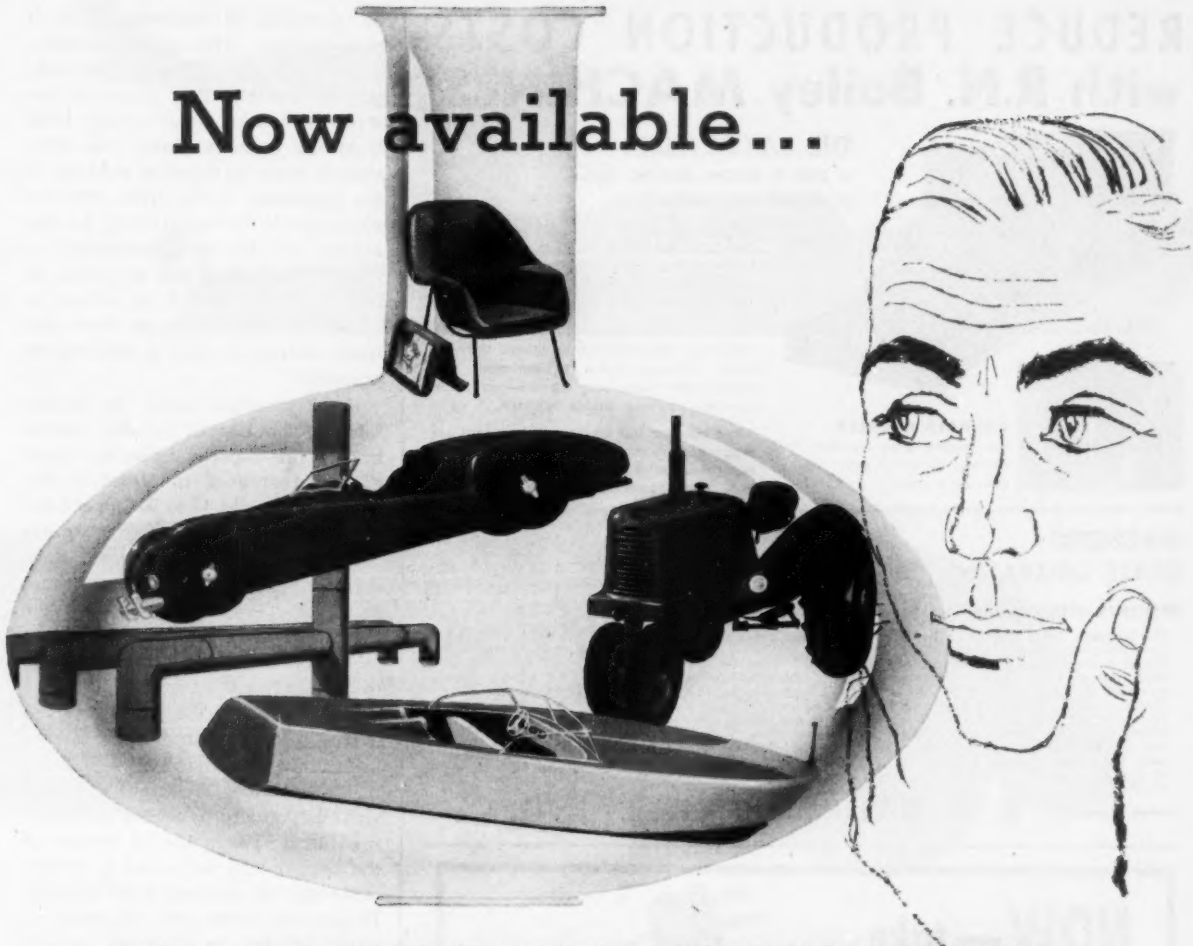

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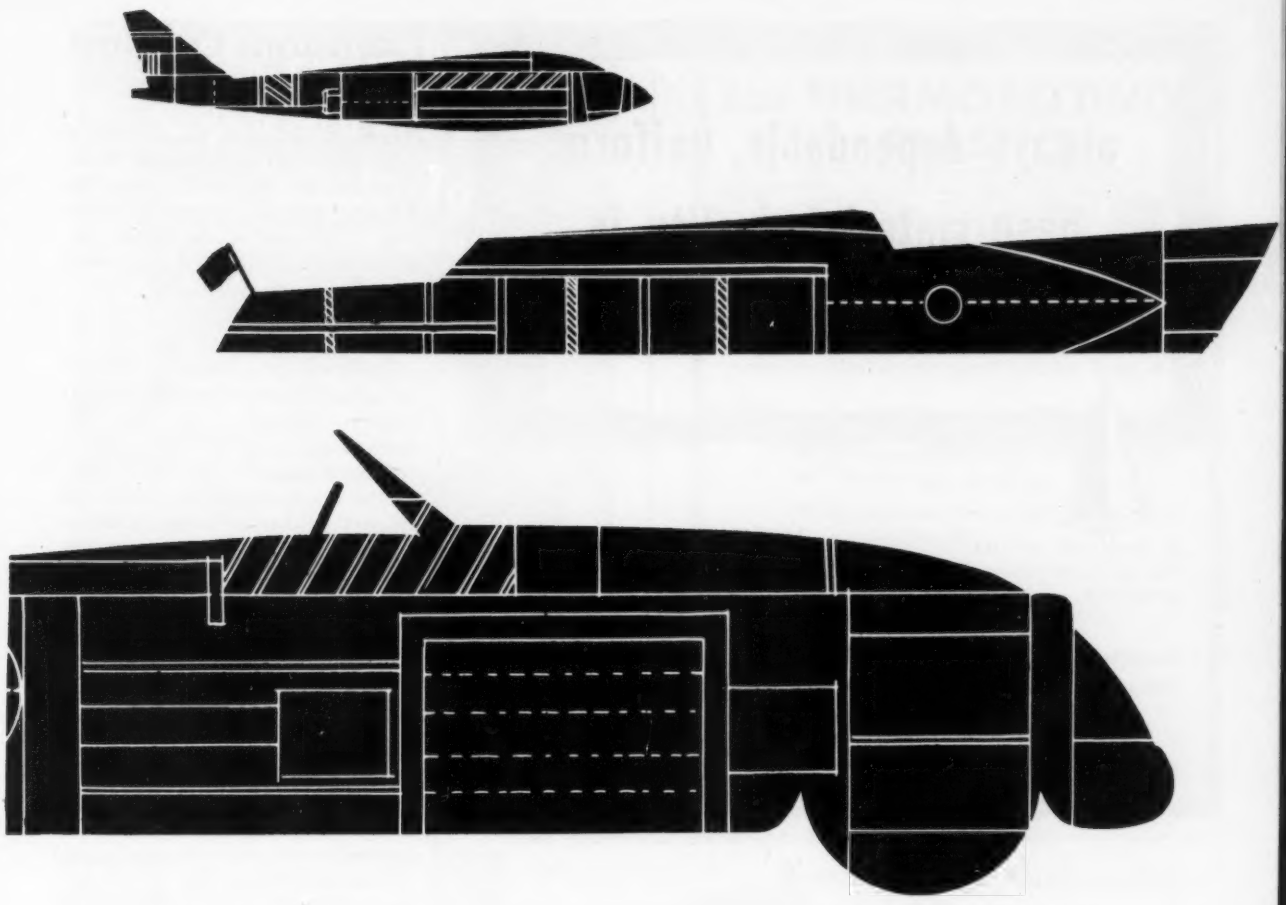
be provided to maintain uniform temperatures without fluctuations. With the longer worms recommended, the compounding action of the screw will take place further back from the breaker plate, thus permitting more mechanical working of the compound in the front cylinder zone with better opportunity for the control of the stock temperature. Longer land dies will be found to be extremely useful in obtaining smooth surfaces on large cross sectional extrusions and in eliminating porosity.

Head pressure must be maintained. The use of breaker plates having full tapered holes in which the open area of the head or die side is decreased 40 to 50% has been found to be effective in maintaining head pressure without recourse to a fine screen pack. This is particularly helpful in handling heavily loaded stock without clogging screens, reducing output, and requiring frequent cleanouts.

Dry blends are fed directly to the extruder hopper, although preheating the dry blend assists in obtaining better rates of output and also reduces porosity by added drying of the blend. The angle of repose of the hopper may be varied to permit more efficient feeding of the powder. Hoppers equipped with vibrators are most helpful in insuring proper feeding, especially in the case of clear vinyl formulations where the dry blend is somewhat fluffy and not of a sandy texture as in dry blends which contain either fillers or stabilizers in solid form.

Because of the critical role of plasticizers in determining the desired properties in a polyvinyl chloride or vinyl copolymer compound for any specific application, it is important that plasticizers be chosen carefully. The selection of a formulation is always a problem of obtaining the best balance in a range of properties, not only with the characteristics of the end product in mind but with compounding and extrusion characteristics as well.

To do this wisely, a working knowledge is necessary of the primary properties of the various plasticizers—compatibility, efficiency, volatility, low-temperature flexibility, and resistance to extraction—as well as of such secondary properties as flammability, odor, color, and toxicity.—END



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Extrusions Cut Cost

(*Continued from p.* 108)

degree of diffusion to provide a suitable veiling of the lamps. When viewed at 90° or directly under the diffuser, the ratio between maximum brightness of the plastic diffusers and acoustical baffles shall be not more than 3 to 1."

Extrusion Method

Conditions of production include use of high heat resistant Plexiglas; uniform delivery of material through a corrugated die having a developed length of over 45 in.; control of die temperature; control of delivery so that variations in thickness due to non-uniform cooling and take-off will not result in unusual strains; control of cooling to prevent excessive distortion on the finished sections; and prevention of distortion as the shape cools.

Initial design of the extrusion die allowed for maximum variation in flow of the methyl methacrylate. Sufficient metal was allowed on the lands and leads for making corrections after testing and in actual production.

Final synchronization of all factors—1) control of pressure and viscosity of the material as it leaves the extruder; 2) uniform control of flow to the die orifice; and 3) maintenance of uniform take-off and cooling rates—has produced corrugated sheets to the requirements of the engineers and at a cost low enough to broaden the market for the finished product.

Improved Performance

R. D. Burnham, illuminating engineer with Wakefield, reports that the extruded sheet has no significant change in light transmission, but the ability to mask lamp brightness has improved 25 percent. This means an over-all lighting efficiency without one portion of the plastic being noticeably brighter than another.

Another favorable by-product of the extruded sheet is its improved dimensional stability. Under accelerated tests it was found that cold flow has been reduced. The span for cast sheet was so specified that no objectionable sagging could occur; the extruded material offers an extra endurance factor.—END

Air Conditioning

(*Continued from p. 107*)

hood, a refrigeration unit in the front of the trunk compartment, and air distribution ducts which circulate the cooled air to all parts of the car interior. Air intakes located on the outside of the body, on the rear quarter panels, pick up approximately 60 cu. ft. of air per min. at 50 m.p.h., forcing it into the evaporator unit, and thence into the air ducts. This produces a slight pressurization in the body interior and improves the inside air.

A typical Oldsmobile air conditioning system comprises two formed ducts of clear transparent Plexiglas sheet which extend from the rear package shelf and carry the cooled air to the distribution ducts concealed beneath the headlining. These curved ducts conduct the air efficiently and, at the same time, permit driver and passengers to see out the rear window without having their visibility obstructed, as would be the case with opaque ducts.

The overhead distribution ducts, which connect with the transparent ducts and extend along each side of the roof, directly above the doors, are of two types. In the four-door sedan models, they are installed beneath the headlining for this purpose. In the Holiday (hard top) models, these ducts are formed of high impact styrene, with flocking applied on the outside surface to match the headlining color. The entire duct system in a typical installation is just under 7 pounds.

Four sets of manually adjusted air jets and fixed louvers, located for the convenience of front and rear seat passengers, provide a considerable flow of cool air. This can be directed, if desired, directly into the faces of car occupants during the brief cooling-down period or when operating the car under very slow traffic conditions. Tests made by Oldsmobile have proved the ability of this air conditioning system to maintain the temperature of the inside air at from 70 to 72° F., despite outside temperatures ranging to 104° F.

CREDITS: *Acrylic ducts are supplied to Oldsmobile by Cadillac Plastics Co., Detroit, Mich., and L. A. Darling Co., Coldwater, Mich. Styrene ducts are furnished by L. A. Darling Co.*—END

Strain Effects

(*Continued from pp.* 141-148)

methyl methacrylate than for polystyrene. Therefore, it was again felt that a greater variation in heat distortion temperature would have been noted for polymethyl methacrylate at lower mold temperatures.

Three lots of polymethyl methacrylate were molded with the same limitations: bubble formation and stuck sprues below a mold temperature of 55° C. A large part of this difficulty in molding at low mold temperatures was thought to be inherent in the design of this mold and/or the injection press rather than in the polymer. All the specimens tested in this study were free of imperfections (i.e. bubbles, sink marks, etc.)

As the spread between the transition and mold temperatures increased, the scatter in heat distortion values also rose (Table V, p. 148). Since the values obtained at 0.060-in. distortion approximated the values obtained on the corresponding annealed moldings at the same deflection, it is concluded from this and from the characteristics of the previous graphs that these higher heat distortion temperatures do reflect the intrinsic heat distortion values for these polymers.

The authors are deeply grateful to the American Cyanamid Co. for the use of its laboratory facilities.

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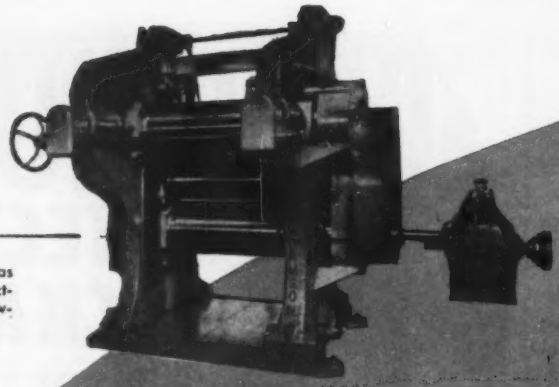


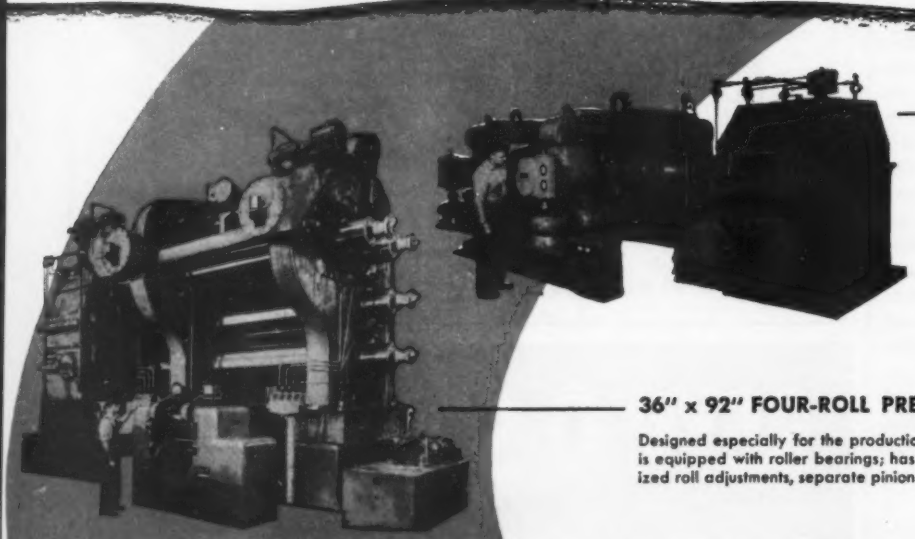
16" x 36" FOUR-ROLL CALENDER

For rubber and sponge products. Has sleeve bearings, herringbone connecting gears, manually operated screw-downs, and grease lubrication.

20" x 54" THREE-ROLL CALENDER

For medium speed production of various types of rubber products. Equipped with herringbone even speed and friction gearing, sleeve bearings, grease lubrication, and motorized roll adjustments. Drive can be adapted to suit available space.

ADAMSON UNITED CALENDERS -

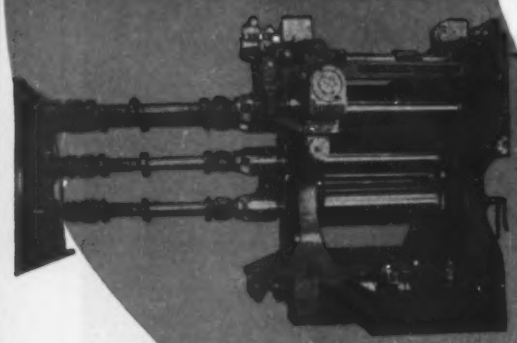


30" x 54" TWO-ROLL HORIZONTAL CALENDER

For finishing asphalt floor tile. This machine is equipped with roller bearings, drilled rolls, pinion stand drive with universal couplings, motorized roll adjustments, and adjustable speed control for tandem operation.

36" x 92" FOUR-ROLL PRECISION CALENDER

Designed especially for the production of thin plastics film up to 72" wide. This unit also is equipped with roller bearings; has roll crossing and zero clearance equipment, motorized roll adjustments, separate pinion stand with universal couplings and flood lubrication.

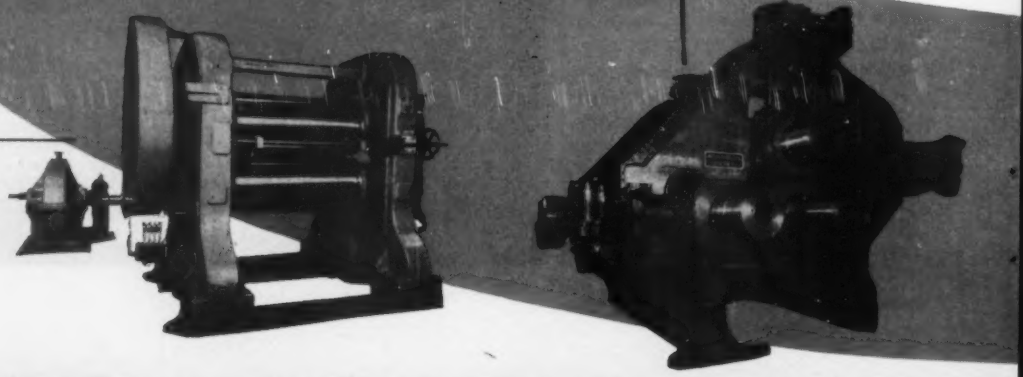


24" x 68" FOUR-ROLL DELUXE PLASTICS CALENDER

Produces 57" wide film at high speeds. Has roller bearings, zero clearance equipment, roll crossing device, roller bearing universal couplings, drilled rolls, motorized stock guides and flood lubrication. Drive is through a separate pinion stand which has its own complete flood lubrication system.

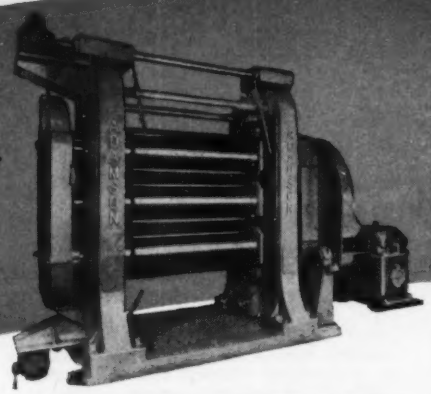
24" x 68" FOUR-ROLL Z-TYPE RUBBER CALENDER

For high speed double-coating of tire fabric. Has sleeve bearings with grease or flood lubrication, motorized roll adjustments, herringbone connecting and drive gears, plus other features required for high speed production.



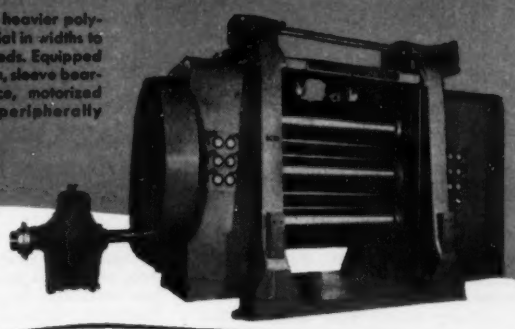
24" x 52" TWO-ROLL CALENDER

Another Adamson calender, vertical type, used in the production of floor tiling.



24" x 68" FOUR-ROLL STANDARD PLASTICS CALENDER

Produces 2 mil and heavier poly-vinyl chloride material in widths to 57" at medium speeds. Equipped with flood lubrication, sleeve bearings, zero clearance, motorized roll adjustments, peripherally drilled rolls.



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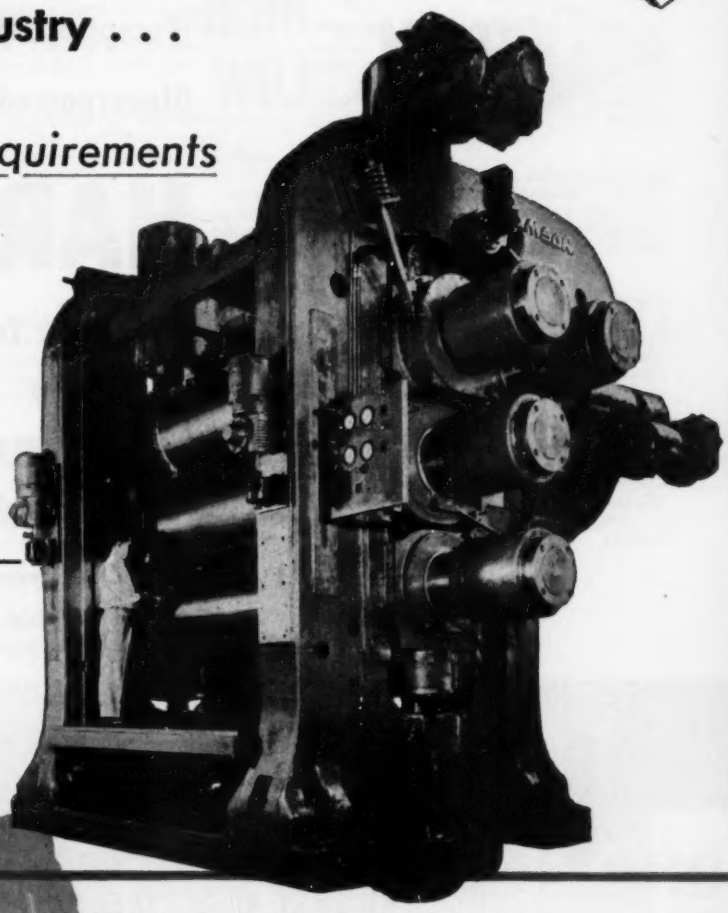

32" x 92" FOUR-ROLL PRECISION CALENDER

This unit is geared to produce 72" wide vinyl film, 2 mils and less in thickness, at production speeds up to 150 YPM. It is equipped with anti-friction bearings, zero clearance, motor operated stock guides, motor operated roll crossing device, flood lubrication, universal couplings, pinion gear stand, drilled rolls and automatic temperature control. The electrical drive includes separate DC motors for each component, with speed trimming devices. Auxiliaries consist of embossing equipment, cooling unit and automatic turret-type windup.

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Stabilizers

(*Continued from pp.* 150-154)

ity (9, 11). The strontium salts give fairly good light stability with quite good heat stability for many applications. Further, they are considered as non-toxic because strontium salts have long been used for medicinal purposes. Although they are still being used generally, they are now particularly useful in vinyl solution formulations where their excellent solubility permits easy incorporation in the compound. For this work they give sufficient heat and light stability and large quantities were used in the vinyl cocoon film after the last war.

Barium salts have not been used widely but they have some special properties which require consideration. Their biggest use is in combination with cadmium types and this will be discussed later. The two products generally employed are barium stearate and barium ricinoleate, especially the latter. It gives good clears, is a good lubricant, and imparts fair heat stability when used in ratios of 2 to 4% based on the resin, but in such high ratios tends to over-lubricate and cause spewing. When used at high temperatures a pink discoloration occurs. To overcome these objections barium 2-ethyl hexoate has been recommended, but at the present time it is not used extensively. Sulfide staining has been a problem, but recent work indicates that certain types of barium stabilizers, alone or in combination with other metals, give excellent stabilizers without staining.

Tin Stabilizers

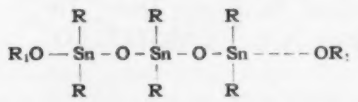
The organo metallo tin stabilizers are based on tetravalent derivatives. The divalent compounds are not suitable as stabilizers and are rarely employed, except in special cases. The tin compounds give excellent heat and light stability and produce vinyl products of outstanding clarity not approached by any other stabilizer. They also seem to be non-toxic, and show excellent outdoor aging characteristics without exudation tendencies. These properties are particularly important for clear compounds which are used extensively outdoors.

Among the first of these stabiliz-

ers was dibutyl tin dilaurate. This was and probably still is used extensively by one of the earliest and largest vinyl resin producers which has a very strong patent position on their use in vinyl resins. Included in their patent position was the dibutyl tin maleate and the oxide.

The chief drawback of the dilaurate was its limited compatibility with vinyl resins, which could cause heat sealing difficulties at high ratios or if the compound was not purified and prepared under strict conditions. The presence of the laurate radical was also objectionable because of its tendency to yellow at high temperatures and therefore colorwise it was not all one would want. Further, the films always had the odor of lauric acid. The oxide derivative was not compatible and hard to disperse in vinyl resins. The best of this group was the maleate which had outstanding heat stability. Its chief difficulties were in processing and compatibility; it was difficult to mill into the resin, caused sticking due to poor lubrication, and had a tendency to plate out on the calender rolls.

Recognizing that these organo tin stabilizers seem to be the ideal approach to vinyl resins, an extensive research program was initiated to develop organo tin stabilizers that would overcome the difficulties mentioned and that could be offered to the vinyl industry in general without any patent blocks. Our initial tin stabilizer was unique in that it was an organic tin stabilizer that was polymeric in nature. It permitted us to vary the molecular structure so that we could obtain stabilizers of improved and special properties. Stabilizer #3, offered to the industry in 1948, was a polymeric compound which had the structure:



R is usually a butyl group but other groups can be used. The technique of polymerization and synthesis of such products is the subject of several patents (9, 10).

Among the unique properties of such stabilizers is that they seem to function with all types of polyvinyl chloride resins including copolymers. The only exception to this are certain European resins which have phenolic based emulsifiers left in the resin, catalysts, or in some cases a high soda content.

The most recent development in the field of organo tin stabilizers is a type containing sulfur linkages; these materials have outstanding stabilizing properties in most of the resins in so far as heat is concerned. Preliminary investigation indicates that they are one of a group of the most powerful stabilizers known for vinyl resins. Unfortunately they have drawbacks, such as the typical odors of sulfur-bearing materials and inferiority to other tin stabilizers in light stability. Another very serious drawback is cross staining with other metallic stabilizers, such as cadmium and lead.

Their unique properties, however, make them of use particularly in the rigid type formulations as well as in plastisol formulations. Some of them also function quite well in certain types of European resins.

It is interesting to speculate how these organo-tin stabilizers containing sulfur act during stabilization. The highly reactive sulfur compounds, which are liberated from

the stabilizer during the heat treatment, can react with the degraded polymer in at least two ways: 1) they can react with the double bonds similar to the well-known vulcanization reaction forming cross linkages, thereby eliminating the formation of conjugated double bond systems; or 2) they can probably react with the carbonyl groups formed during the heat treatment to produce mercaptals which are very stable sulfur derivatives, and they may be preferentially formed in the presence of traces of hydrochloric acid as catalyst. They can act also as anti-oxidants, as they can react with the oxygen of the air with the formation of disulfides.

Recently a method has been developed for quick drying of oil and varnish films by passing the films through an atmosphere of sulfur dichloride. Thin films can thus be dried in a matter of seconds. This reaction may be related to that involved with the organo-tin stabilizers containing sulfur.

Cadmium Stabilizers

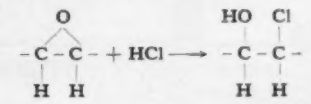
The cadmium salts have been revived recently in the stabilizer field. Cadmium stabilizers have been used in the past for some clear compounds where only mild heat stability is necessary. They impart fair to medium light stability. Originally cadmium stearate was used, generally less than 1% based on the resin. Higher ratios were incompatible and caused spewing as well as heat sealing difficulties. One of the good properties of cadmium stabilizers is that they prevent color formation during initial heat history but conversely on prolonged heating they sharply turn to purplish brown or jet black. With the recognition of synergistic action of cadmium with other metals this type of stabilizer has become of great importance. This will be discussed later. The types offered commercially are cadmium ethyl hexoate, mercaptide, ricinoleate, and naphthenate.

Alkaline and Epoxy Compounds

The use of sodium carbonate as a stabilizer has been extensive in Europe, particularly Germany, but is not used at present in the United States and, in general, does not stabilize the common vinyl resins made in this country. The alkaline phosphates, however, are used in the

United States. They give good light stability and are used for this purpose. They have poor heat stability and are never used by themselves but always with a good heat stabilizer, as they detract from heat stability. The ones offered at present are based on sodium phosphate and sodium polyalkyl phosphates.

The ability of the epoxy group to absorb hydrogen chloride is well known and these materials function on this basis, presumably forming the following compound:



They are not good heat or light stabilizers and are not used by themselves except in special applications; but rather are ordinarily used in combination with a metallic stabilizer. Here a synergistic action takes place and as usual the combination gives better heat and light stability than either component used alone. The epoxy compounds must be high molecular weight, otherwise they are toxic and can cause dermatitis.

The epoxy materials are particularly effective as stabilizers when chlorinated or phosphate plasticizers are present and they are now used for this purpose extensively in the United States. Epoxy stabilizers are also useful with the organo tin compounds when phosphate esters are present.

Recently there have been offered epoxy type plasticizers that act as stabilizers. They are based on epoxydated fatty esters or alkyd type plasticizers. They must be used in low ratios to prevent spewing or incompatibility, especially in light.

Chelating Compounds

The term "chelating" has recently been introduced to the stabilization terminology. Such compounds have received wide acceptance in the United States and are very popular here at the present time. Exactly how they function is not known but it appears that they work as chelating types or complexing agents for metallic chlorides, similar to sequestering agents in the dyestuffs industry.

That they do complex certain metallic chlorides can be readily seen

by taking a vinyl resin compound with 1% lead stearate and adding 1 to 2% chelating agent. The improved clarity is immediately observed. Certain of these compounds may also act as anti-oxidants and some of them act as acid absorbers. Some of the compounds are closely related to anti-oxidants that have been used in the past to stabilize unsaturated systems. No doubt infra-red techniques mentioned previously would be very useful in studying the action of these compounds. In general, the composition of such chelates is not revealed, but the ones that are on the market seem to be based on phosphorus derivatives, although non-phosphate types can also be used.

Besides their use to improve clarity in compounds, chelating stabilizers are also used to improve heat and light stability in lead stabilized compounds. As already mentioned, in many cases they clear up the "fog" caused by lead stabilizers, presumably by complexing the lead chloride formed. One of the outstanding uses of chelating agents is to give good initial color during processing and this has become very important in vinyl stabilization.

Stabilizer E-49 is a compound of this type which has remarkable stabilizer properties with cadmium and barium compounds in that it gives long term stability without yellowing or what is called initial color stability. In some resins it permits heating for 60 to 75 min. at 330° F. without any appreciable yellow color showing up. This is a new and important step in stabilization chemistry (12).

Synergism

Finally, we come to an interesting phase of stabilization, especially heat stabilization, that is called synergism, meaning cooperative action. It has been found that by using combinations of metallic stabilizers it is possible to obtain stability not obtained by either one alone. How synergism functions during stabilization is not known as yet. One theory proposed is that the metal components of the stabilizer combination have different rates or ability to react with hydrogen chloride, thus permitting a longer extension of heat stability. Most of the stabilizer systems that show synergistic action are ordinarily used in com-

bination with complexing or chelating agents to give best results. The best example of synergism is the use of barium and cadmium soaps together. For example, if 3% barium ricinoleate is used alone as a stabilizer, a dark brown film will be formed in about 75 min. at 300° F. If 3% cadmium ethyl hexoate is used alone, a purple or black film will result in 20 to 35 minutes. However, if equal parts, that is, 1½ parts barium and 1½ parts cadmium are used, the film remains colorless even after two hours. The synergism principle is also useful with epoxy and chelating stabilizers. By this synergistic action two to three times the heat stability of the barium or cadmium compounds alone can be obtained. By carefully controlling the ratio of barium to cadmium, a stabilizer can be obtained that gives outstanding heat stability and quite good light stability to most vinyl resins. Research has shown that approximately 60% barium to 40% cadmium gives optimum results. The most common of these is Stabilizer BC-12 which is a barium-cadmium laurate. Unfortunately, if too high ratios of this type are used, some calendering difficulties may be encountered. The chief of these is a plating out effect or precipitation on the calender rolls. To overcome this, modifications (13) of these systems have been developed that give excellent heat and light stability without the plating effect and that also give vinyl compounds of clarity not approached by any other metallic stabilizers except tin stabilizers.

Zinc

The use of zinc in vinyl resins has always been considered unsafe as it quickly gives black compounds on heating. Recently, however, through the use of synergism, zinc is being seriously considered as a stabilizer in combination with an alkaline earth metal, or better still, the two metals together with a chelate type stabilizer. In general, zinc resembles the synergistic action of cadmium when used with barium and calcium. It is important that the ratio of zinc to barium, for instance, be closely controlled. Somewhere in the range of 10% zinc to 90% barium is a useful ratio, being much lower than for cadmium.

The main interest in zinc type of

stabilizer is for non-toxic stabilizers, especially when used in combination with calcium type stabilizers. Another use is in non-staining to sulfur stabilizers; for this the barium-zinc type stabilizers are used. An advantage is, of course, the low cost of zinc. At present the zinc laurate or barium-zinc laurate is being offered as well as zinc salts of various synthetic acids. They are not as yet used on large commercial scale and considerable caution must be exercised in their use.

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(13) Advance Solvents & Chemical Corp., Technical Data Sheet, Stabilizer 89X.—END

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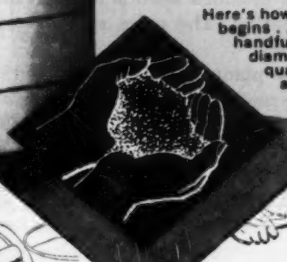

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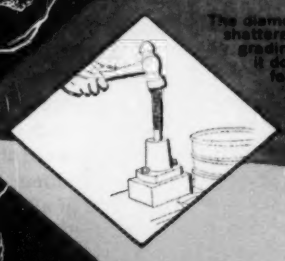

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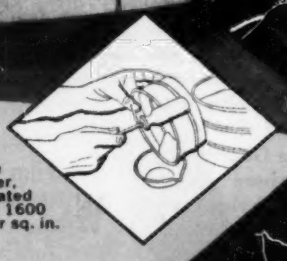

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NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Polyethylene News

INTEREST in Du Pont's new Alathon 10 polyethylene is running high among molders, extruders, and paper coaters. After September 1, Du Pont changed over completely from its old-type Alathon to the new and improved Alathon 10 which, according to various users, is a considerably improved material over Alathon I and Alathon II which were previously offered.

Most sensational claim that has come to this department's attention so far is that of an extruder who is exhibiting a reasonably clear film made from Alathon 10. It is not as clear as cellophane or cellulose acetate, and the degree of clarity claimed depends upon the extruder to whom one is talking. Some have had better results than others. Up to this time, the principal objection to a more clear polyethylene film has been that it would "block." That is, the sheets would stick together. The extruder of this film claims that he has no such difficulty with Alathon 10. Says he can wind it on take-off machine at fairly high temperature with no sign of sticking. Du Pont claims only "greater transparency" for film made from its new material and says nothing concerning the possibility of blocking. However, it is assumed that the producer was at least reasonably certain that the blocking problems had been at least minimized before he put a product on the market.

Advantages claimed for new material—Extruders are also claiming several other advantages for this new material, in addition to greater transparency. For example, it has greater stiffness and higher softening temperature and can therefore be run at a faster rate. Because of greater stiffness it can supposedly be run through packaging machines faster than the more limp film made from the previous Alathon. No data are available on its printing surface.

Some processors who use Alathon film on paper seem to be quite happy about the new material and claim that it will give greater grease resistance, better adhesion—which, of course, is extremely important in paper coating—greater transparency, lower moisture vapor permeability than before, and, in some cases, they think a ½-mil coating of film on paper will do a better job than a mil of the older type of Alathon. The idea seems to be that a pound of Alathon 10 will go a lot farther or produce a much bigger yield than the former Alathon II.

Molders have not had the new material long enough to be thoroughly familiar with its characteristics, but those who have experimented report: "It looks good." Molded items should have the same advantages in upgraded properties as mentioned above for film. It is believed that the new material will also give shorter cycles and permit use of thinner walls, thus increasing yield per pound of molding material.

Molders and extruders are both rapidly learning that Alathon 10 must be handled differently than the previous Du Pont material, but are not anticipating any more than the usual adjustments necessary whenever a modified resin is brought into the market. The price remains unchanged.

New plants in 1954—Introduction of the new Du Pont material has not helped the supply situation for polyethylene from a volume standpoint since no new capacity is involved in the change-over. The new Du Pont plant addition in Orange, Texas, is not expected to be producing until sometime in the first half of 1954.

It is believed that the Government is now taking somewhere around one-fifth of all the polyethylene produced for D.O. orders.

At the present time, it is believed that total polyethylene production is not much over the 10- or 11-million lb. volume which it has been since late in 1952. During some of the past months it has been several million pounds under that figure due to production problems. The new 60-million lb. a year Bakelite plant at Texas City, Texas, is now producing small quantities, but probably won't be up to its 6 million lb. per month rate until December. It is believed that 1953 total production of all polyethylene will be around 140 million lb. in contrast to about 100 million lb. in 1952.

Industry will soon absorb new supply—It hardly seems likely that the industry can absorb all of that 6 million lb. increment, which is due in December, as soon as it comes in. Of course, the users' inventories will be built up immediately, but as soon as that feat is accomplished, polyethylene may be in a comparatively free supply position for two months or so. It will probably tighten up again next spring or at least until the new Du Pont increment is operating at full blast.

Then the Bakelite 60-million lb. plant at Seadrift, Texas, is due to come in during the third quarter of 1954, and possibly Tennessee Eastman will start producing late in that year. The third new Bakelite plant in California is not due until the middle of 1955. By that time, Spencer Chemical is hopeful of being in production. Monsanto, Dow, and National Distillers have all stated that they expect to have their plants in operation some time that year or even earlier, but none of them have recently issued a progress report.

Users will expand operations—It is confidently believed by all the analysts that there will be a considerably increased demand for polyethylene just as soon as present users and potential users find out that supply is sufficient to expand their present operations and feel that they can be assured of enough material to start production of new products. It looks now as though that period of comparatively free supply over a sustained period of time will start about the middle of 1954 or shortly thereafter.

Film for Civil Defense

WINNERS of the United States Government's recent contract for 5000 rolls of vinyl film were Plymouth Rubber Co., Inc., Canton, Mass., and Monsanto Chemical Co.,

* Reg. U. S. Pat. Office.

VISIBILITY

by Swedlow

IN THE BOEING RB-47E

THE U.S.A.F. RB-47E "Stratojet", now in quantity production by the Boeing Airplane Co., is the world's fastest day or night long-range photo reconnaissance airplane. The optical precision of its Swedlow-fabricated laminated plastic enclosures contributes substantially to the remarkable performance of this specialized weapon of the democracies. For information on transparent plastic glazing applications, contact the Swedlow plant nearest you.

Swedlow
PLASTICS CO.

THE PLASTISCOPE

Springfield, Mass. The contract calls for clear and translucent-type flexible vinyl film, with dull matte finish, 0.004 in. thick, in rolls 54 in. wide by 350 lineal yd. long.

The country was divided into zones and prices asked for various deliveries in each zone. Plymouth won the zone 1 bid for 2100 rolls at a price of $64.25 a roll. Zone 1 included all states along the Atlantic Coast from Maine through Virginia. Monsanto won the contract for all other zones at a price of $65.33 a roll for each zone.

There were 20 bidders. The lowest bid was disallowed. Other than this unaccepted low bid of $60.48 in zone 1, the bids range from the prices mentioned here up to $80.50 a roll, except for one considerably higher made by a cast film producer. Most of the offers were in the high 60's or low 70's.

The completed film is to be shipped to various locations in the country, where it will be stored by Civil Defense to be used as a window glass substitute in case of bombings and concussions.

A contract for a liquid adhesive to be used with the film was let at the same time. The winner was B. F. Goodrich Co., Akron, Ohio, which walked off with an order for 6250 units of liquid adhesive at $5.90 per unit.

Black for Polyethylene Pipe

A HIGH quality carbon black is being dispersed in virgin polyethylene to practically colloidal fineness for use in extruding black polyethylene pipe. The black dispersion concentrate is made by Acheson Dispersed Pigments Co., Philadelphia, Pa., a Unit of Acheson Industries, Inc.

The use of carbon black serves a two-fold purpose. The first is, of course, to color the pipe. The second, and most important, is to protect the polyethylene from the deteriorating rays of the sun. Actual tests have proved that the protection furnished by carbon black to polyethylene extends the life of the plastic by several hundred percent. Also, the degree of protection is based on the fineness of the pigment, which acts as a barrier to the sun's rays.

Therefore, to get the most efficient use of the carbon black, it must be colloidally dispersed. A 2% dry black content is considered adequate for most uses, although additional advantages have been obtained in concentrations up to 5 percent. The dispersion concentrate can be furnished with or without stabilizers. The carbon black content is 25% and the polyethylene content is 75 percent. It is shipped in granulated form and is completely dustless. Due to the present short supply of polyethylene, the resin is temporarily furnished by the customer.

For plastics pipe extruders who want to color pipe for identification purposes, a complete range of colors is available. These colors also have extremely fine particle size, and are available as dispersions in all of the resins used by the plastics pipe industry.

Methylstyrene

CONFIRMATION of the Certificate of Necessity granted to American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., for a methylstyrene plant at Avondale, La., was implied at the recent American Chemical Society meeting in Chicago. Company representatives at that meeting told of their experiments in developing polymers from methylstyrene and dimethylstyrene. The monomer was produced by reacting acetylene, produced from natural gas, with toluene.

However, company officials say that not a spadeful of ground has yet been turned at the site where the plant is supposed to be built and that the project is still in the realm of uncertainty. But the general opinion in the trade is that since American Cyanamid has gone this far, they will proceed the remaining distance to eventual completion of a plant within the not too distant future.

The proposed plant, if built, will be the second in the United States to produce a styrene type monomer from toluene. The Dow Chemical Co. has gone far enough with its vinyltoluene plant, from which a similar monomer is produced, to advertise that their material is now available for developmental work.

Until the new Dow plant came into production, all styrene was produced from benzene and ethylene. Benzene has been a scarce chemical almost constantly since World War II days until a year ago when petroleum companies entered the field. In 1952, production of benzene from coal and gas amounted to 216 million gallons. Petroleum companies added 35 million gal. to the total and will increase their production capacity by a considerable amount over that in the next two years. But even this vast amount could be critically short in wartime because of the ever growing needs and uses found for benzene.

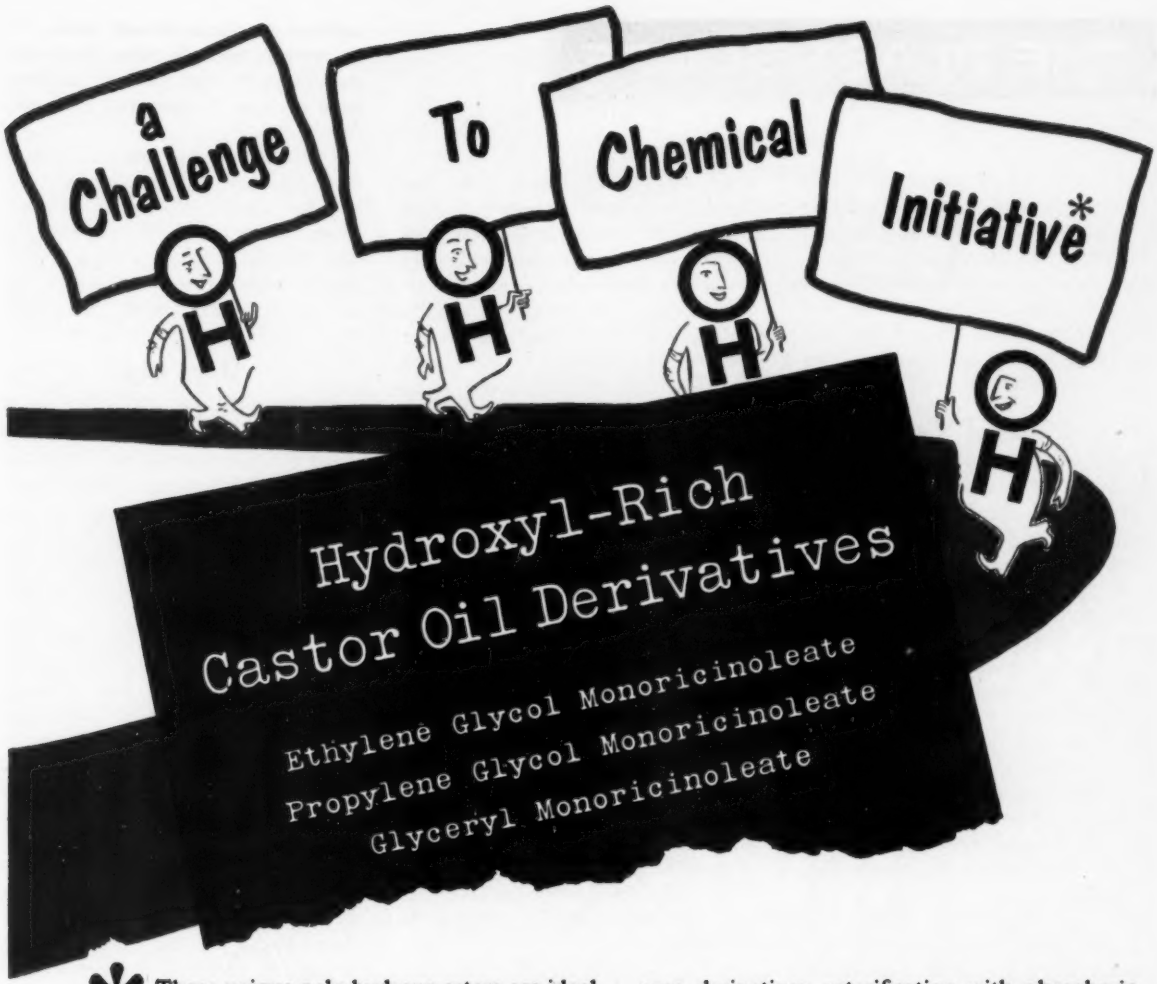
A total of 106 million gal. of toluene was produced in 1952, 64 million gal. of which came from petroleum. Capacity is much, much greater than that figure. Consequently, if toluene can be used to produce styrene, it should relieve the strain on benzene, even though toluene too would have many important uses in wartime that are now relatively quiescent.

There is also a price factor involved. Benzene sells for 40 to 43¢ a gallon. The toluene price is 32 to 35¢ a gallon.

Cyanamid technicians say that polymers produced from methylstyrene and dimethylstyrene have shown outstanding properties for injection molding, surface coating resins, and low-pressure laminating compounds of greater heat resistance. The monomers appear to be alternative materials for styrene in the production of synthetic rubber and in the rapidly growing fields of styrenated alkyd resins for coating and laminating uses.

Dow's similar material, vinyltoluene, is advertised as having a flash point of 60° C. in comparison to 31° C. for styrene, and a freezing point of −82.5° C. in comparison to a −30.6° C. for styrene. The high flash point would seem to indicate at least that these new monomers would be less dangerous, or let's say, "easier" to handle than straight styrene.

There has been no publicity in regard to the comparative brittleness of the new polymers in con-



* These unique poly-hydroxy esters are ideal starting points for synthetic conversion. Possible reactions of these multi-hydroxy esters are sulfation, acylation, iso-cyanate coupling, acetalization. oxidation, amination, condensation with urea derivatives, esterification with phosphoric acid.

The presence of the polar hydroxyl group suggests their use as surfactants, cellulosic plasticizers, dye carriers, lubricants, and cosmetic ingredients.

POLY-HYDROXY ESTERS	HYDROXYL VALUE
Ethylene Glycol Monoricinoleate	260
Flexricin® 9 (Propylene Glycol Monoricinoleate)	288
Flexricin® 13 (Glyceryl Monoricinoleate)	304

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trast to standard polystyrene, but laboratory results would indicate they are comparable. Both Dow and American Cyanamid have emphasized their prospective excellence as paint vehicles. Two reasons are that the new materials react more rapidly and have higher flash points than normal styrene.

Colored Wire

THE first company to provide samples of wire coated with Kel-F and colored with striping ink for identification purposes is The Rex Corp., Hayward Rd., West Acton, Mass. The new colored wire takes advantage of M. W. Kellogg Co.'s new ink which has been developed specifically for printing on Kel-F.

Before development of this wire, it was necessary to use solid colors. Now the wire can be coated in one operation and then printed with any color desired; and it is possible to obtain as many as 50 or 60 varieties, depending upon the number of different wires which the user wishes to identify.

It is practically the same system for wire identification used in vinyl coated wire, but until recently no ink was available which could be satisfactorily printed on Kel-F.

Organic Stabilizer

FURTHER information on Duranyl stabilizers for vinyl chloride, recently mentioned in this column, has been received. The producer, Alframine Corp., 4731-4661 E. 52nd Dr., Los Angeles 22, Calif., reports that Duranyls are organic stabilizers and free of any metallic compounds. They are claimed to be non-toxic, non-flammable, and non-irritating to the skin. It is stated by the producer that the stabilizers will prevent corrosion of the metal on mills, calenders, extruders, and molds and are compatible with practically all plasticizers. He says that they will prevent discoloration of vinyls when exposed to heat, bright sunlight, or ultra-violet rays. The producer recommends them particularly for use with inexpensive alkylated aromatic plasticizers, since the Duranyls will help to counteract darkening of finished vinyl goods when that type plasticizer is used. Another feature claimed for Duranyls is that their use in vinyl compounds will help destaticize the finished product.

Concerning this feature of destaticizing, a company bulletin states: "Since high temperatures and longer periods of time reduce the anti-static properties of our Duranyls, we highly recommend that the lowest technically possible temperature at the shortest time should be applied. The incorporation of Sovaloid C, monononyl-napthalene, or similar aromatics, reduces temperature and time while still forming very tough plastics. The percentage of those aromatics should be approximately the same, or even higher, than the percentage of Duranyl. Formulations have been achieved in which three (3) times as much monononyl-napthalene or Sovaloid C as Duranyls have been used. Certainly there is no guarantee for a completely anti-static vinyl plastic, since even metals develop static."

Copies of the bulletin on Duranyls may be obtained by writing to Alframine.

School for Plastics

INSTRUCTIONS in the use of plastics materials for construction purposes was given to a group of corrosion engineers and maintenance men by The Atlas Mineral Products Co., Mertztown, Pa., during the week of September 21.

The faculty consisted of technical personnel from chemical companies and engineering and research organizations.

Plans are under way to repeat the course as often as is necessary in order to take care of the heavy demands and interest that has been expressed. Those interested should contact Joseph A. Snook, vice president in charge of sales of Atlas.

Price Changes

READJUSTMENT of its price list for Plexiglas acrylic plastics sheets has been announced by Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa. A price reduction in the form of a discount of 5% was instituted on shipments of 3000 sq. ft. or more of a single item. The company reports that this is the first time such a discount has been offered.

The new schedule also includes a 2% discount on orders for untrimmed sheets, and raises the minimum quantity on a single order that will be accepted by the manufacturer from 150 sq. ft. to 500 sq. feet. Charges for cut-to-size sheets were raised slightly.

Mylar Film

MEMBERS of the supervisory staff of Du Pont's new Circleville, Ohio plant for the manufacture of Mylar polyester film held their first meeting in Buffalo, N. Y., where the film is being made in experimental quantities. The Circleville plant is expected to start operations in the latter part of 1954.

Emory F. Ridlon will be plant manager and Peter J. Meshkoff, works engineer. Mr. Ridlon was formerly manager of the Yerkes Film Plant and Mr. Meshkoff was chief supervisor at the Chambers Works of Du Pont's Organic Chemicals Dept. at Deepwater, N. J.

Thiokol-Epoxy Combination

LIQUID polymers of Thiokol compounded with epoxy resins have now been on the market long enough to acquire a fair amount of knowledge on compounding and performance. Formulas and applications have been assembled in a portfolio available from Thiokol Chemical Corp., Trenton 7, N.J.

This comparatively new combination of resinous materials is especially fitted for potting, adhesive, and coating fields. Compounds varying from elastomers to hard resins are prepared by co-curing Thiokol liquid polymers with liquid epoxy resins. Processing is described as simple mechanical mixing at room temperature.

It is obvious from a look at the properties charts of these two unusual materials that a combination of the two could result in a product of outstanding merit. Epoxies are noted for adhesiveness, chemical resistance, flexibility, toughness, and negligible shrinkage. Thiokol, a polysulfide synthetic rubber, is particularly noted because it is unaffected by aging, weathering, ozone, or sunlight at temperatures ranging

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from −70 to +250° F. without the use of plasticizers. It is highly impermeable to gases, moisture, and liquids. It is used in permanent putties, where it is unaffected by oils and most solvents and as a sealant that is easily applied and will adhere tenaciously to glass, wood, and metal. Other uses are as a coating for paint spray booths, for ink and paint rollers, as a binder for cork, a material for gaskets or diaphragms, and many others.

Increasing the concentration of the polysulfide liquid polymer makes the copolymer more flexible and resilient, faster converting, lower in shrinkage, and usually lower in initial viscosity. Increasing concentration of epoxy resin makes the copolymer better in electrical properties, tougher, and more resistant to deterioration at elevated temperatures. One formulation has been immersed in boiling water for over 800 hr. with but slight volume and weight change.

Adhesive formulations based on the Thiokol-epoxy combinations are claimed to demonstrate that the copolymer gives more permanent flexibility, lower shrinkage, more efficient bonding, lower application costs, better low temperature flexibility, and greater fluidity of mix than either epoxy or Thiokol when used alone. The adhesives can be cured either at room or elevated temperatures, depending on the formulation.

Lightweight Vinyl Film

AVAILABILITY of a premium lightweight film which will sell at 60¢ a pound, several cents higher than the average price of similar gage film, has been announced by The Pantasote Co., 26 Jefferson St., Passaic, N. J. The company asserts that this move is an effort to provide exceptionally high quality film to combat quality reduction which it claims has been rampant in the industry for some time.

The new lightweight material is available in Pantasote's standard colors and has the following advantages: heat and light stability, tensile strength, cold temperature properties, and low volatility. It is also claimed to meet the fire laws and general requirements for clothing.

Cedar Odor

DEVELOPMENT of a cedar odor for use in vinyl garment storage bags has been announced by Sindar Corp., 330 W. 42nd St., New York 36, N. Y. It is claimed that the material will retain pleasing, long-lasting odor qualities after being subjected to high milling temperatures.

Samples are available upon request from Sindar.

The company has also developed a new all-purpose, inexpensive deodorant under the trade name of Dodall #1. It is recommended for use to mask various industrial odors.

Bottle Prices

AN average price reduction of 10% on Plaxpak polyethylene carboys and prime line stock squeeze bottles has been announced by Plax Corp., West Hartford, Conn. This reduction follows a 2% across the board price cut announced in May.

The company states that new production methods and expanded production facilities, coupled with increased availability of raw polyethylene, are credited with making the price reduction possible. Plaxpak bottles are manufactured in Stonington and West Hartford, Conn., and Louisville, Ky.

Plax also announces the opening of a West Coast district office at 4501 S. Santa Fe Ave., Los Angeles, Calif., to be headed by Richard W. Hall, former Cleveland district manager. To service the San Francisco area, M. Walthall Turner will establish resident headquarters at 300 Seventh St., San Francisco, as assistant to Mr. Hall.

Molds for Vacuum Forming

UNBREAKABLE molds for vacuum forming made from a specially treated aluminum alloy have been announced by Victory Mold & Die Co., 53 West 36 St., New York 18, N.Y. The molds can be made with either a satin- or chrome-like finish. The over-all thickness is usually between ¼ and ⅜ in.; it is therefore easy for the manufacturer to drill the required vacuum holes. These units are being built to produce products that may range from doll faces to refrigerator door or freezer liners.

Victory asks that their customers supply them with either approved plaster models or accurately formed samples from which Victory will work when making the mold that is to be used in the vacuum press. A rough sketch of the mold layout should be enclosed with the model and this sketch should include the approximate outside mold dimensions, width of clamp-down flange, desired depth, or anything else that should be incorporated in the mold.

High Boiling Phenols

THE first tank car shipment of high boiling phenols from the new Carbide and Carbon Chemicals Co.'s coal-hydrogenation plant at Institute, W. Va., has been delivered to a resin manufacturer. Carbide asserts that this particular phenolic compound contains various materials not commercially available in any other phenolic mixtures. The mixture can also be used in the manufacture of phenolic lubricating oil additives, cresylic-type disinfectants, surface-active agents, and pharmaceuticals.

Plastic Aid for Printing

GLASS fabric coated with Teflon is now being used in the printing industry to prevent smudging of pages in collating troughs, ink pick-up and offsetting from folder rollers, breaks and tears of roto sheets as they go over forming noses of folders, and the adherence of backing material to plastics electrotype plates.

Officials of Du Pont, which produces this material, claim that Teflon-coated glass fabric is particularly efficient for these purposes because of its exceedingly low coefficient of friction which prevents sticking. Moreover, the material is chemically inert to inks, solvents, acids, and other materials used in printing and allied fields. For example, it is used as a 3-in. Teflon-coated glass fabric tape spirally wound around steel rolls over which printed newsprint passes on the way

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to the folding machines. The tape is anchored to the rolls with a Du Pont "Fairprene" cement. Another type of single-ply construction is used by a publishing company as a separator-release sheet in plastic molding operations for making electrotype plates.

Urea Producer Moves

PURCHASE of the Plaskon Div. of Libbey-Owens-Ford Glass Co. by Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y., has been recently announced. According to publicity reports, L-O-F sold the division in order to direct its activities to fields more closely integrated with glass, its major product. L-O-F originally acquired Plaskon in 1940.

The principal plastics resins sold by Plaskon in the past have been urea, melamine, and glass-filled alkyd molding powders. The division was one of the original producers of allyl-type polyester resin.

The Plaskon facilities will now be operated as a unit of the Barrett Div., Allied Chemical & Dye Corp. The Barrett Div. started production of phenolic resins only a couple of years ago and is also a large-scale producer of plasticizers for synthetic resins. Allied Chemical is also a producer of phthalic anhydride, which is widely used in the plastics industry; Genotron, a fluorocarbon monomer which is used in the production of fluorocarbon polymers; and has recently started production of crystal urea.

The Solvay Div. of Allied Chemical is also a producer of low molecular weight polyethylene, which is the type generally used with paper for such items as bread wrappers.

Fungicide

A FUNGICIDE specifically developed for use in vinyl-coated fabric or paper used for shoe linings has been announced by Nuodex Products Co., Inc., Elizabeth, N. J.

Designated as Nuodex 100 VT, the fungicide comes in liquid form and is easily incorporated in vinyl coating compositions, where it is compatible with all commercial resin-plasticizer-stabilizer combinations. Its purpose is to stop bacteria and fungi from attacking the organic plasticizers which are formulated with the coatings.

Nuodex 100 VT is one of a series of special- purpose fungicides which the company has developed for use with vinyl compositions.

Polyethylene Laminate

COST reductions averaging 21¢ per pound for its polyethylene cellophane laminate, Cellothene, have been announced by Cheslam Corp., a Div. of Chester Packaging Products Corp., 284 Nepperhan Ave., Yonkers 2, N. Y. All gages and combinations are affected.

Company spokesmen claim that added plant area and new equipment, plus increase in experience, have made it possible to bring down their original prices on this comparatively new material.

Fluorocarbon Adhesion

DEVELOPMENT of processes and facilities for sealing Teflon to Teflon and Teflon to metals has been announced by Graef Engineering Co., P. O. Box 416, Clearwater Station, Paramount, Calif. The seal has a tensile strength approximately equal to the tensile strength of the Teflon itself.

Teflon tapes, previously available in maximum widths of only 6½ to 12 in., can now be fabricated to any desired width through the use of this sealing process. This development opens the way for the application of Teflon tapes to bags, sacks, fuel cells, tank liners, protective clothing, laboratory dishes, and many special surfaces where sealing is the only method.

A variation of this process can be used to bond Teflon tapes to metal surfaces, producing extremely strong composites.

Nylon Filament

ADOPTION of Tynex as the trade mark for its level and tapered nylon filament has been announced by Du Pont. To distinguish the company's product from other nylon filaments now reaching the market was given as reason for the move. The word nylon itself has been generic in this country since the product was first announced in 1938.

Manufacturers using Du Pont nylon filament in their products will be eligible to employ the Tynex trade mark, with the customary acknowledgment of its ownership. These include toothbrushes, household brushes, paint brushes, and fishing lines and leaders.

Ion Exchange Resins

A WIDE range of anionic, cationic, and non-ionic softeners, as well as anti-static resins, has been added to the textile line of Catalin Corp. of America, 1 Park Ave., New York 16, N. Y.

In conjunction with the addition of these products, Catalin has increased laboratory personnel experienced in textiles and installed complete facilities for testing and evaluating treated materials.

Electrical Laminates

LAMINATES of a grade designed to utilize glass mat reinforcement are now available from Westinghouse Electric Corp., 401 Liberty Ave., Pittsburgh 30, Pa. Outstanding properties of this type of Micarta are good electrical insulating qualities and excellent moisture resistance, together with considerable toughness and a high impact strength.

Designated as Micarta Grade No. 20608, the material can be used in many applications where a high strength, insulating laminate is required, such as circuit breakers, coil washers, and rotor wedges.

For a panel ⅛-in. thick, moisture absorption is 0.35% and the dielectric strength is 350 v. per mil. The new grade of Micarta is available in thicknesses from 1/16 to ¾ in. in panels 28 by 37 inches.

Bag for Desiccants

NON-WOVEN fabric bags which breathe are now being produced for the packaging of desiccants and used in military and commercial shipping containers. The bags are particularly valuable for protecting metal from corrosion and clothing from mildew.

The fabric, called Lantuck, is treated with B. F. Goodrich Chemical Co.'s vinyl latex and distributed

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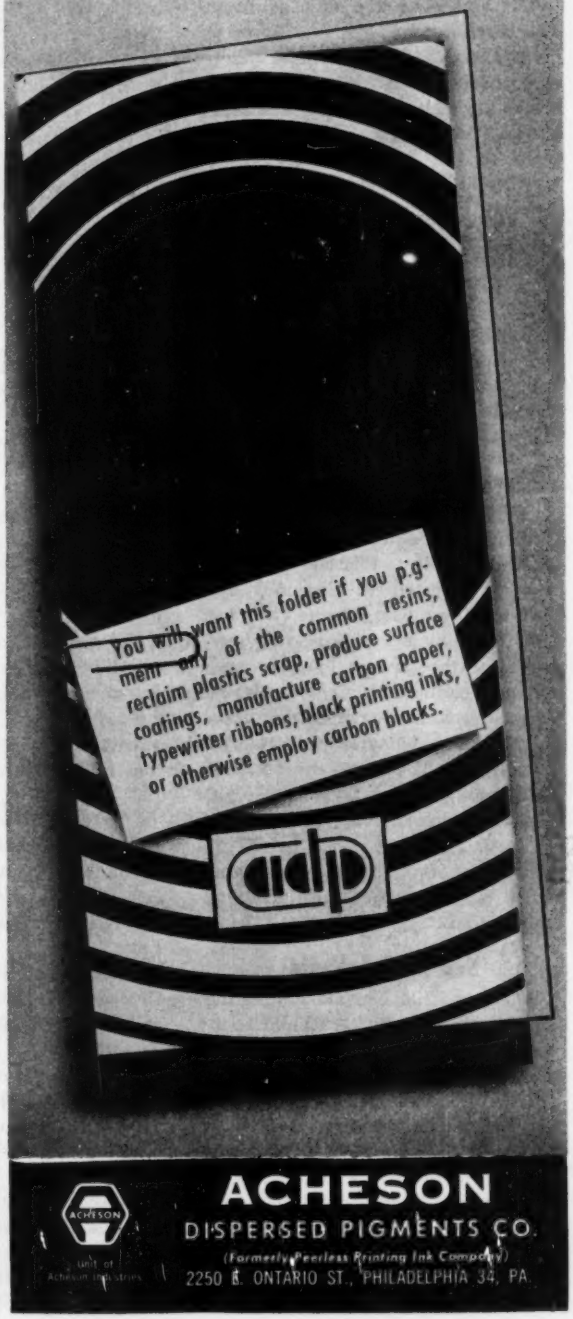

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(Formerly Peerless Printing Ink Company)

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by Wellington Sears Co., 65 Worth St., New York, N. Y. It is claimed that Lantuck differs from most bonded fabrics in that it has almost completely random distribution of fibers, giving it equal strength in all horizontal directions. The vinyl latex is added as a binder saturant. The combination latex and fabric is dried and then run through a calender where the binder and fibers are sealed together and given a smooth surface. The finished fabric is supplied to the bag manufacturer in 40-in. width rolls.

Nylon Film

NYLON film is now being produced in this country by The Garrison Co., 1 Columbus Ave., Kenilworth, N. J. The 1 mil thick nylon film has exceptionally good adhesive properties and at present its use is being limited almost exclusively to the purpose of joining fabrics together.

Aerial Delivery Containers

A CERTIFICATE of Necessity for plant and equipment expansion of approximately $850,000 has been recently granted to Chemold Co., 2308-10 Broadway, Santa Monica, Calif. The company is presently engaged in the production of aerial delivery containers for the Marine Corps and Air Force and arctic sleds for the Army Quartermaster Corps, using hydraulic presses and matched metal molds.

In addition, Chemold has a proprietary item, an 8-ft. by 32-in. translucent structural building panel which is also molded with matched metal molds.

Non-Shrink Resin

TWO new, non-shrink laminating resins, Toolplastik L-900 and Toolplastik Gelkote L-910 are being introduced by Rezolin, Inc., 5736 W. 96th St., Los Angeles 45, Calif. They are both modified epoxy resins with 100% solids content and will not settle. The materials are claimed to be the first non-shrink laminating resins to be placed on the market. Tests indicate that both resins are neither corrosive nor brittle and are easy to handle, apply, and cure at room temperature. Special facilities and equipment are not required.

The company developed L-900 and L-910 primarily for use with glass cloth reinforcing in such tooling applications as the fabrication of jigs and fixtures, models, prototypes, molds, tool masters, etc. Toolplastik L-900 is for standard laminating applications, while L-910 produces a high gloss surface on laminating tools. Both are often used in the same tool to produce surface finishes that do not require polishing or machining. The resin L-910 is used to form the surface layer and is backed up by reinforcing glass fabric and L-900 to the required thickness.

Laminate for Paper Machines

HIGH-pressure laminates made by St. Regis Paper Co.'s Plastics Div. are being used by the company on its new giant size Beloit Fourdrinier machines at St. Regis' paper mill at Jacksonville, Fla. Designated as Panelyte, the laminate is reported to be particularly applicable for this purpose. It is nonmoisture absorbent and shows little reaction to temperature variations.

Panelyte is used around the wire on the Fourdrinier because it reduces wire wear and power losses due to friction. Through use, it acquires a smooth polished surface that is both hard and durable.

Metallic Coating

DEVELOPMENT of a pigmented metallic coating for thermosetting plastics such as phenolic and polyesters has been announced by Logo, Inc., a subsidiary of Bee Chemical Co., 13799 S. Avenue O, Chicago 33, Ill. The material is called Logoquant P-6 and it is claimed that no such metallic coating has heretofore ever been developed for phenolics and polyesters.

According to the company, Logoquant P-6 was developed especially for the purpose of providing a metallic coating for decorating phenolic radio and television cabinets. The coating requires only approximately 10 min. bake-time at 250° F. as against the standard 40 min. at 300° F. for thermosetting plastics coatings. In addition, the coating can be used on urea and melamine and would therefore be acceptable for dishes and various other kitchen utensils.

Help for Boat Makers

SPECIAL consultants have been retained by Owens-Corning Fiberglas Corp., Toledo, Ohio, to survey the fibrous glass reinforced plastics-boat field. The organization, Gibbs & Cox, Inc., 1 Broadway, New York, N.Y., will conduct technical surveys into various existing fibrous glass plastics boat manufacturing techniques, develop design data for vessels, help interpret Government small boat specifications, and seek to chart directions toward obtaining best applications of fibrous glass reinforced plastics in boat construction.

Dimer Acid

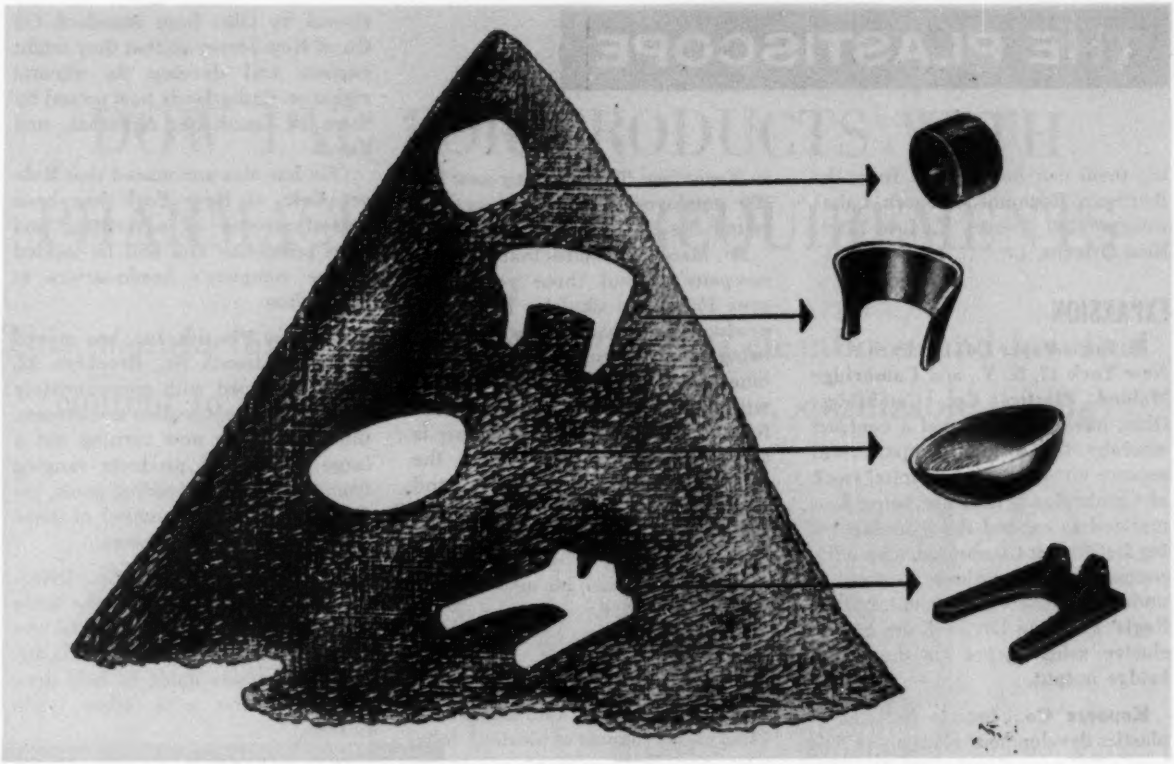
EXPANDED facilities for producing dimer acid have been announced by Emery Industries, Inc., 4300 Carew Tower, Cincinnati 2, Ohio. Improvements in processing methods have been developed to produce a lighter colored product. The new production will be designated as Empol 1022 polymerized fatty acid to avoid possible confusion with other unrelated dimers.

The company reports that full-scale production of Empol 1022 is anticipated early in December. Shortly thereafter, Empol 1022 will completely replace the present Emery 955 dimer acid.

Plasticizers from Fat

NEW synthetic fats—acetoglycerides—have been evaluated as secondary plasticizers for vinyl resins by screening tests conducted at the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory. These new acetoglycerides have been tested with vinyl resin and the most commonly used primary plasticizers; it was found that the plasticizing qualities were generally improved in each case. They are recommended especially when tricresyl-phosphate was the primary plasticizer and also look promising as extenders for dioctyl sebacate.

The acetoglycerides are being produced by a commercial company on a pilot-plant scale to obtain samples for evaluation. Information concern-



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Wouldn't you like to tap *new* markets . . . make *extra* dollars next year on your present capital investment? You can . . . and here's how:

Day-by-day, lumber mills and woodworking shops accumulate huge quantities of sawdust, scrap and other waste wood. The disposition of this waste is a never-ending, and expensive problem.

Yet, recently, a large and growing demand has developed for such items as chair backs and seats, hamper tops and other products molded of granulated wood, bonded with special Monsanto adhesives research-built for this particular job.

As a compression molder, *you* have the necessary molding equipment right in your plant to turn this wood waste into a profit. Using your existing equipment, you could *mold* any number of wood-resin products not competitive with the plastics products you already produce. What better way to tap *new* markets . . . to develop *new* sources of income for your business.

If you'd like to see some of the interesting products now being molded with granulated wood, write for our bulletin No. 78. Use the handy coupon.

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Please send me information on molding granulated wood.

Name & Title _____

Company _____

Address _____

City, Zone, State _____

ing them can be obtained from the Southern Regional Research Laboratory, 2100 Robert E. Lee Blvd., New Orleans, La.

EXPANSION

St. Regis Paper Co., 230 Park Ave., New York 17, N. Y., and **Cambridge Molded Plastics Co.**, Cambridge, Ohio, have consummated a contract whereby the former company will acquire virtually all the capital stock of Cambridge. Plans are being formulated to expand the manufacturing facilities at Cambridge, where the company will continue to operate under the same management, but St. Regis' Panelyte Div. will act as exclusive sales agents for the Cambridge output.

Koppers Co., Inc. is building a plastics development plant on its Kobuta site, near Pittsburgh, Pa. The new facilities will produce semi-commercial quantities of a wide variety of new plastics, which are a result of an extensive program conducted over the past several years.

Owens-Illinois Glass Co., Toledo, Ohio, has invested $8 million in Plax Corp., W. Hartford, Conn., previously a wholly-owned subsidiary of Emhart Mfg. Co. The transaction, which had been announced as impending last June, followed a favorable decision by the U. S. District Court in Toledo on a petition by Owens-Illinois.

Newly issued Plax stock sold to Owens-Illinois is equal in amount to the Plax stock owned by Emhart. It is expected that a small amount of additional Plax stock will be issued to one or more members of Plax management. Emhart has not sold any of its Plax stock, all money from the sale going to Plax.

Mastro Plastics Corp., 3040 Webster Ave., New York 67, N. Y., is planning a $1 million plant expansion, according to Mario Maccaferri, president. This is the third expansion in three years for this company which produces such items as plastics ukuleles, guitars, clothes pins, and acoustical tile. Completion of the 28,000-sq. ft. plant is expected late in November. The company now has 200 employees and operates on a round-the-clock six-day basis.

Mr. Maccaferri states that since the company's debut three years ago, over 1½ milion ukuleles have been produced and that 5000 per day are being produced currently. The combined sales of guitars and ukuleles will hit over $1 million this year. He further reports that the company is also producing clothes pins at the rate of one-half million per day and, that the dollar value of wall tile has reached $1¼ million per year. He expects the wall tile volume to reach $3 million a year when his new installation is completed.

COMPANY NOTES

The Sun Rubber Co., Barberton, Ohio, mass producer of plastisol dolls, toys, and balls, now observing its 30th Anniversary, has announced that its sales volume is double that of a year ago and that it is heading for one of the biggest 12 months in its 30-year history. The company has 1000 employees operating in two or three shifts, depending upon the department involved.

Sun also announces that **Willard T. Davis,** formerly associated with General Aniline Film Corp. for nine years, has been named vice president and factory manager and **Walter S. Raymer, Jr.**, former assistant secretary, has been promoted to vice president and controller. The other vice president recently appointed is **William R. Lantz**, director of purchases.

Elmes Engineering Div., American Steel Foundries, manufacturer of Elmes hydraulic presses and equipment, has appointed **John E. Bush** as district representative for the Chicago territory. Mr. Bush's new headquarters are at 410 N. Michigan Ave., Chicago 11, Ill., the main office of American Steel Foundries.

Olin Industries, Inc., East Alton, Ill., announces the election of Harold F. Moses as president of **Interstate Natural Gas Co.**, Monroe, La. He will also serve as general manager of Olin's newly created Oil and Gas Div. Interstate was recently purchased by Olin from Standard Oil Co. of New Jersey so that they might explore and develop its mineral rights on timberlands now owned by them in Louisiana, Arkansas, and Texas.

Olin has also announced that **Robert Cole** of New York has been named director of advertising and sales promotion and will be located at the company's headquarters at East Alton.

Aquador Plastics, Inc. has moved to 62 Eighteenth St., Brooklyn 32, N. Y. Equipped with approximately 50 electronic heat sealers and presses, the company is now turning out a large volume of products ranging from card cases to wading pools, inflatable toys, and a number of items used by the Armed Forces.

The Federal Leather Co., Belleville 9, N. J., has changed the trade name of its elastic fabric-backed upholstery from Fedistron to Fedlastic. The change was made to help prevent confusion with other trade brands.

Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, has established two new autonomous divisions—Plastics and Agricultural Chemicals Div. and Chromium Chemicals Div. **A. L. Geisinger,** a vice president of the company, will be general manager of the former division.

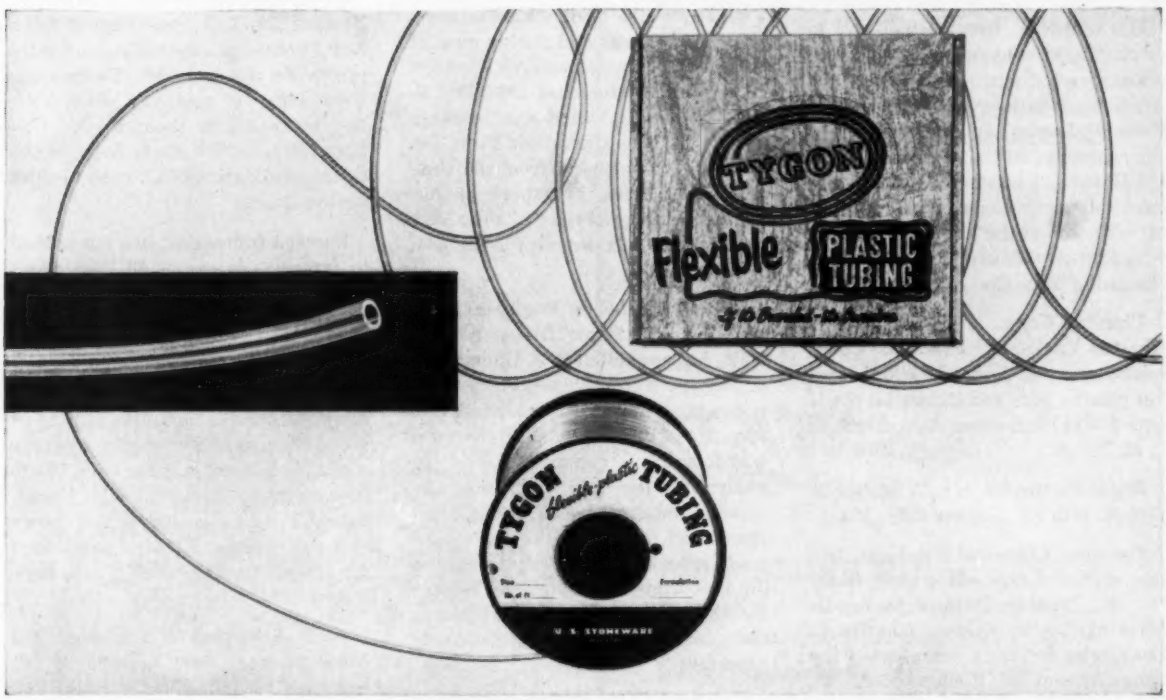
The Blane Corp., buyers and suppliers of vinyl and polyethylene scrap, has moved into new offices and warehouse at 38 Pequit St., Canton, Mass. The company is planning to manufacture reprocessed polyethylene pellets and other by-products being generated by the plastics industry. **Joseph Neipris** is president, **Albert D. Neipris,** treasurer, and **Louis L. Neipris,** vice president.

General Electric Co. announces that **H. Arthur Howe,** manager of the company's plastics plant at Coshocton, Ohio, has been promoted to manufacturing manager of the Laminated and Insulating Products Dept. In his new position, he will continue as manager of the Coshocton plant and will co-ordinate the department's over-all manufacturing activities.

G-E also announces the appointment of **Paul F. Gavaghan** as supervisor of the Chemical Div.'s News Bureau at Pittsfield, Mass., to re-

DOW PVC FOR PRODUCTS WITH PHARMACEUTICAL REQUIREMENTS

This manufacturer selected DOW PVC for its cleanliness and low lead content to produce non-toxic, pyrogen-free, sterilizable tubing



To produce this 2,000-ft. reel of intravenous tubing and packet of blood transfusion tubing, the manufacturer took advantage of outstanding characteristics of Dow PVC 100.

Dow PVC 100 offered exceptional cleanliness and low lead content—extremely important properties in producing pharmaceutical tubing which must be non-toxic, pyrogen-free and suitable for sterilization at 15-lbs. steam pressure.

The special advantages of Dow's PVC packaging entered into consideration, too. The resin was supplied packaged to assure freedom from contamination so that the manufacturer received the highest quality raw material for his exacting requirements. Dow PVC shipping containers include 50-lb. multi-wall paper bags or standard 41-gal saran-lined fiberpaks.

For details as to how to apply the advantages of Dow PVC 100 to your products, write for additional information to THE DOW CHEMICAL COMPANY, Plastics Department PL 1483, Midland, Michigan.

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place **Robert L. Clark** who has assumed an employee relations assignment with the Chemical Div.

Francis Shaw & Co. Ltd., Manchester, England, producers of rubber and plastics machinery, have formed a Canadian company registered as **Francis Shaw (Canada) Ltd.** at Graham's Lane, Burlington, Ontario. **R. D. Gerrie** has been appointed general manager of the new company.

Garfield Mfg. Co., Garfield, N. J., producers of cold molded and allied plastics products, announces the election of **Sydney H. Lichner** and **Peter DeLeeuw, Jr.**, as directors of the company. At the same time, **Gerald H. Howell** was named vice president and general manager. Mr. Howell is the son of the late B. H. Howell, who formed this company in 1908 as Hemming Mfg. Co.

Chesflex Corp., a new division of **Chester Packaging Products Corp.**, has been set up to produce and market plastics pipe and industrial products at 284 Nepperhan Ave., Yonkers 2, N. Y.

Regal Plastic Co. is now located at 2800 E. 14th St., Kansas City, Mo.

Eastman Chemical Products, Inc. has opened a new office at 30 Bloor St., W., Toronto, Ontario, to handle sales of Tenite plastics. **Charles L. Seay**, who formerly represented the company out of Rochester, N. Y., will be in charge.

Robinson Industries, 3051 Curtice Rd., Coleman, Mich., has purchased **Toughbuoy Co.**, Dubuque, Iowa, manufacturers of Toughbuoy water closet floats made of Styrofoam.

Ivano, Inc. has moved to 616 S. Michigan Ave., Chicago 5, Ill.

Erie Resistor Corp., Erie, Pa., announces the following promotions: **J. C. Van Arsdell**, former manager of sales engineering of the Electronics Div., has been appointed assistant general manager of the division; **William Klevans**, field sales engineer in Indiana and southern Ohio, succeeds Mr. Van Arsdell as manager of sales engineering; **William J. Wervey**, former sales engineer in electronics, replaces Mr. Klevans as electronics sales representative. **Malcolm Young**, formerly manager of quality control, has been named assistant general manager of the Plastics Div.

Emery Industries, Inc., 4300 Carew Tower, Cincinnati 2, Ohio, announces that **R. W. Van Tuyle** has been elected a director and to the newly established post of vice president in charge of manufacturing. Mr. Van Tuyle has been with the company for 19 years and during most of that period he was research director. Emery also announces that **Dr. R. Ray Estes** has joined the research staff of its New Chemicals Dept. Dr. Estes comes to Emery from the University of Kentucky where he has been assistant professor of chemistry and director of research for the past seven years.

Society of Plastics Engineers, Inc., 513 Security Bank Bldg., Athens, Ohio, has appointed **P. J. Underwood** as the new executive secretary to fill the vacancy left by the resignation of Mrs. Bess R. Day. Mr. Underwood was formerly a commodity industry analyst for the U. S. Dept. of Commerce, and has been in organizational and public relations work for trade associations. Announcement of the appointment was made by **Walter F. Oelman** of Standard Molding Corp. and currently S.P.E. national president.

Celanese Corp. of America's Plastics Div., 180 Madison Ave., New York 16, N. Y., announces the following appointments: **Dr. David B. Hertz** has been named director of engineering. He joined the company in 1945, and for a time was assistant professor of industrial engineering at Columbia University. Dr. Hertz has added to his staff **C. Myers** as head of the Utilities and Maintenance Analysis Section; **A. P. Berger** as head of the Facilities and Estimates Section; and **H. Weber** as head of the Design Section.

W. R. Porter has been appointed manager of Government business and **W. E. Eaton** and **E. F. Seitz, Jr.** have joined the staff of the Market Development Dept. Added to the staff of the division's Belvidere, N. J., plant are **Edward R. Horan** as head of the Personnel and Safety Dept.; **George Pokrivchak**, to the Technical Control Group; and **Robert E. Stanton**, to the Engineering Dept.

The Plastics Div. also announces the opening of a new West Coast district office at 3460 Wilshire Blvd., Los Angeles 5, Calif. **Richard J. Hough** has been made district manager and associated with him are **Harry Hill** and **Kenneth Wood.** A branch office of the West Coast district, located at 607 Market St., San Francisco, is headed by **W. R. Cooper.**

Continental-Diamond Fibre Co., Newark 29, Del., has named **Olan Ray Thomas** as advertising and sales promotion manager. Mr. Thomas has been with the company since 1941, last representing them to the National Automotive Parts Assn. in the sales coordination of Celoron plastics timing gears.

Seward Industries, Inc. has moved to larger quarters at 68 Eighteenth St., Brooklyn 32, N. Y. The company specializes in the rebuilding of standard make electronic heat sealing equipment. Sales and service cover the East and Midwest. The company announces that a complete display of reconditioned and guaranteed equipment in all sizes, ranging from ½- to 20-kw. output, is available for immediate delivery, including all types and size presses. Custom equipment for special requirements is also produced.

J. P. Schwebel & Co., Inc., 424 Madison Ave., New York 17, N. Y., has appointed **Cadillac Plastics Co.**, 15111 Second Ave., Detroit, Mich., as sales representatives and distributors in the Detroit area. Cadillac will sell the complete line of Schwebel's glass fabrics at direct mill prices and carry inventories in its Detroit warehouse.

Shell Chemical Corp., 50 W. 50th St., New York 20, N. Y., announces the following changes in personnel: **J. J. Lawler**, former Chicago district manager, has been named sales manager of the company's Julius Hyman & Co.'s Div. in Denver, Colo.; **J. K. Robbins**, former St. Louis district manager, succeeds Mr. Lawler as Chicago district manager; **W. C. Lowrey**, former manager of the Eastern Div. solvents department in New York, becomes the St. Louis district

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To the resin chemist, it's

HEXAMETHYLENE TETRAMINE

To the pharmaceutical chemist, it's

METHENAMINE

Other users prefer the shorter name Hexamine. Whatever your favorite name may be -- and there are many others -- you can depend on Heyden "Hexa" for top quality and uniformity. As a prime producer of both the pharmaceutical and industrial grades in large volume, Heyden has the "know-how" to meet your most exacting requirements.

U.S.P. Powder and Granular:
100, 50, 25 lb. fiber drums.

Technical Granular:
75 lb. multiwall bags,
100 lb. fiber drums.

Technical Powder:
50 lb. multiwall bags,
100 lb. fiber drums.

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FORMALDEHYDE

N.F. Solution - - in tank cars, tank trucks, 475 lb. drums, 100 lb. carboys, and bottles.

37% Formaldehyde, Methanol-Free - - in tank cars and tank trucks.

PARAFORMALDEHYDE

U.S.P. X Powder and Flo Granules. 250, 100, 50 and 25 lb. fiber drums.

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Benzaldehyde • Benzoates • Benzyl Chloride • Chlorinated Aromatics
Creosotes • Formaldehyde • Formic Acid • Glycerophosphates
Guaiacols • Hexamethylenetetramine • Medicinal Colloids
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Parahydroxybenzoates • Penicillin • Pentaerythritols
Propyl Gallate • Resorcinol • Salicylates
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manager; **A. P. Howe**, senior technical salesman in Chicago, goes to San Francisco, Calif., as Western Div. chemical products manager.

The Dow Chemical Co., Midland, Mich., has established a plastics production laboratory at the Midland Division. The new laboratory will operate under the supervision of **Dr. W. H. Schuette**, manager of plastics production. **J. L. Amos** will be laboratory director and **A. F. Roche**, assistant director.

Minnesota Mining & Mfg. Co., St. Paul 6, Minn., and **Gustin-Bacon Mfg. Co.**, Kansas City, Mo., have announced an agreement whereby 3M acquires certain Gustin-Bacon patents and inventions relating to the manufacture of fibrous glass reinforced plastics pipe. The agreement also provides that the two companies cooperate in research and development work concerned with perfecting and improving the glass-plastics pipe, together with a line of fittings and couplings. **H. P. Buetow**, 3M president, said that his company is interested in manufacturing and selling the new pipe and fittings just as soon as development has been completed and manufacturing equipment is available. Gustin-Bacon may undertake the manufacture and sale at a later date.

PERSONAL

Eddie Sawyer, formerly manager of the Philadelphia baseball team in the National League, has been named Philadelphia sales representative for **Lurie Plastics, Inc.**, Colonial Heights, Va. His headquarters are at 201 S. Aberdeen Rd., Wayne, Pa. Lurie specializes in custom molding.

William J. Haude, until recently president of Pittsburgh Agricultural Chemical Co., has been named vice president in charge of marketing of **Grace Chemical Co.**, 60 Beaver St., New York 4, N. Y.

L. A. Schlueter, who handled coal tar resins for WPB during World War II, has resigned as deputy director of the Chemical Division of NPA, Washington, D. C., and returned to his former position with the **Coke & Chemical Institute**, 711 Fourteenth St., Washington, D. C. Mr. Schlueter joined the division at the beginning of the Korean trouble.

M. Dean Fullerton has been appointed New England district sales manager of the chemical division of **Koppers Co., Inc.**, Pittsburgh 19, Pa. Mr. Fullerton was formerly supervisor of the division's sales office and replaces J. W. LaBelle, who has resigned.

Theodore H. Booth, general manager of the **Bonded Products and Grain Div., The Carborundum Co.**, Niagara Falls, N. Y., has been elected vice president by the board of directors.

John L. Turner has joined the technical staff of **Russell Reinforced Plastics Corp.**, 521 W. Hoffman Ave., Lindenhurst, N. Y. He will be in charge of tool engineering and design research.

B. F. Hantz has been elected vice president in charge of sales of **American Insulator Corp.**, New Freedom, Pa. Mr. Hantz has been with the company for 35 years and was formerly in charge of the research and development program. His last major assignment in that capacity was the organization and installation of the company's reinforced molded plastics division.

A. K. MacInnes has been appointed to the technical sales staff of the industrial products division of **Canadian Resins and Chemicals Ltd.** at the Toronto, Canada, district office.

William H. Young has been named assistant general manager of **Brilhart Plastics Corp.**, Old Country Rd., Mineola, N. Y. In addition to the company's usual custom molding, they are currently specializing in fluorocarbon and nylon moldings. Mr. Young has been with Brilhart for the past four years.

Joseph Lupo, for nearly 30 years president and general manager of Lupomatic Tumbling Machine Co., has joined **Lupoline Automatic Polishing Equipment Corp.**, 99-111 Columbus Ave., Tuckahoe, N. Y., as president. Mr. Lupo will head production and have full charge of the company's laboratory and research work.

Wesley E. Weber has been named development engineer of **Furane Plastics, Inc.**, 4516 Brazil St., Los Angeles 39, Calif. Mr. Weber was formerly materials process engineer of Hughes Aircraft Co.

Joseph N. Kuzmick has been appointed coordinator of corporation research and development of **Raybestos-Manhatten, Inc.**, 61 Willett St., Passaic, N. J. Mr. Kuzmick has been with the company's rubber division for over 30 years, during which time he has been active in the development of asbestos and sintered metal friction materials, abrasive and diamond wheels, resins, and plastics products.

E. F. Anderson has been transferred from **Monsanto Chemical Co.'s** Chicago office to become resident sales representative for the Plastics Div. for the Minneapolis-St. Paul area. His headquarters will be in the Foshay Tower Bldg., Minneapolis, Minn. Mr. Anderson will handle the sale of all Monsanto's plastics, except industrial resins and Saflex vinyl butyral interlayer for safety glass.

MEETINGS

Oct. 26-31—Annual Paint Industries Show, Chalfonte-Haddon Hall, Atlantic City, N. J.

Oct. 27—Association of Consulting Chemists and Chemical Engineers, Inc., Annual Meeting and 25th Anniversary, Hotel Belmont Plaza, New York, N. Y.

Nov. 9-12—Refrigeration Equipment Manufacturers Association, Refrigeration and Air Conditioning Exposition, Public Auditorium, Cleveland, Ohio.

Nov. 30-Dec. 5—Chemical Industries Exposition, Commercial Museum and Convention Hall, Philadelphia, Pa.

Dec. 3-4—Society of the Plastics Industry, Fifth Film, Sheeting, and Coated Fabrics Div. Conference, Commodore Hotel, New York, N. Y.

Dec. 13-16—American Institute of Chemical Engineers, Annual Meeting, Hotel Jefferson, St. Louis, Mo.

Vol. 1, No. 3

Advance Info

Published by ADVANCE SOLVENTS & CHEMICAL CORP.

One of a Series on Production Aids — Clip and Save for Reference

OUTSTANDING NEW ORGANO — TIN SULFUR STABILIZER PROVES ONE OF MOST POWERFUL FOR VINYL COMPOUNDING

Stabilizer 17M Gives Exceptional Heat and Light Stability For Both Flexible and Rigid Vinyl Compounds

One of the most powerful heat stabilizers yet developed for vinyl compounding is now available in *Stabilizer 17M*, a new polymeric organo-tin sulfur stabilizer.

An achievement of the Advance Solvents & Chemical Corp. laboratories, *Stabilizer 17M* is completely compatible with all vinyl chloride resins, as well as with most co-polymers. It is compatible with and soluble in practically any of the plasticizers used in vinyl compounding and imparts great clarity and transparency for superior vinyl films with good printability and heat sealing characteristics. Its performance at prolonged cycles at high temperatures is outstanding.

A special advantage of *Stabilizer 17M* is its ability to stabilize even those vinyl compounds containing high percentages of phosphate plasticizers which, normally, inhibit the heat stabilization qualities of most metallic types of stabilizers.

With its other merits, *Stabilizer 17M* is sufficiently powerful to require extremely low concentrations yet gives exceptional heat stability —as little as 0.75% for flexible vinyl compounds (increasing to 1.0-1.5%, based on resin, where the compound is exposed to very severe heat cycles). For rigid vinyls, where *Stabilizer 17M* is most effective and makes for exceptional clarity, 3-5% based on the resin is generally recommended.

Still another outstanding and advantageous use of *Stabilizer 17M* is in the compounding of plastisols. Here, its stabilizing properties permit a longer heat cycle for fusion without discoloration, allowing the use of higher temperatures for greater tensile strength and tear resistance. Plastisols containing *Stabilizer 17M* are remarkably free of tack and have an excellent dry feel.

Complete data, available upon request, outlines all the advantages *Stabilizer 17M* offers. Technical assistance on the use of *Stabilizer 17M* is also available from *Advance* without obligation.

EFFECTIVENESS, ECONOMY, MARK ALL ADVANCE TIN STABILIZERS

The complete line of Advance Solvents & Chemical Corp. organo-tin stabilizers, produced to exacting standards, are designed to meet every need for vinyl stabilization, giving maximum effectiveness, improved surface appearance and reduced rejects. Increased processing speeds also are often gained with these superior stabilizers.

Where, for example, retarding breakdown and discoloration of vinyl compounds during processing at high temperatures is important, *Stabilizer #3* at 2-3%, based on resin (as little as 1% for thin films where heat time history is low), will perform with maximum efficiency. It offers, at the same time, excellent clarity and light resistance; is readily soluble; is easily added during compounding and is compatible with vinyl chloride and copolymer resins.

Advance *Stabilizer #52*, a premium grade light and heat stabilizer, offers extreme clarity, brilliance and light resistance as well as outstanding heat stability, is compatible with vinyl chloride and copolymers and, a liquid, is extremely stable for storage, readily soluble. *Stabilizer #52* is ideal for calendered film, fused coatings, extruded plastics, etc., and cannot be duplicated for outside weathering.

One of the latest Advance developments in organo-tin salts, *Stabilizer OM-10* is unique in its characteristics of less volatility and odor at high temperature processing. It is especially useful for transparent and crystal-clear vinyl stocks with results, particularly in pressed-polished vinyl sheets, unduplicated by any other stabilizer. *Stabilizer OM-10* is also particularly effective for plastisols and organisols where films of high clarity and transparency are desired.

Information on the full line of Advance Stabilizers is available upon request.

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EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (used or resale only)

MACHINERY and EQUIPMENT FOR SALE

PARTIAL LIST of available machines, may be inspected in operation: Small plastic molding plant in New England w/5 machines, etc. for sale; New 4 ounce Acme, November delivery; 60 ounce Jackson & Church, used 1 wk., $37,500. 32 ounce Reed-Prentice, new 1950. 24 ounce DeMattia, $20,000. 22 ounce Impco vertical. 22 ounce Reed-Prentice, new 1948, $23,000. 16 ounce Reed-Prentice, new 1946, $16,000. 12 ounce Lester, $9,500. 12 ounce Reed-Prentice, new 1950, will accept terms. 9 ounce H.P.M., 1946, $10,000. 8 ounce Reed-Prentice, new 1946, $9,500. 8 ounce Reed-Prentice, single link, $7,300. 12 ounce Watson-Stillman, Model E, 1952 machine. 4 ounce Reed-Prentice, 1945. 4 ounce Lester, $4,000. 3 ounce Fellows, new. 2 ounce Fellows, 1951, $5,500. G. E. Dielectric Heater; vacuum plater 4' cap.; Stokes 15 ton single stroke preform press; 300 ton French Oil self-contained hydr. compression press, $5,500.; 200 ton Stokes; 150 ton Stokes; 60 ton Watson; 50 ton Stokes automatic, Model 235-A; Leominster scrap grinder 5HP. ACME MACHINERY & MFG. CO., P.O. Box 731, 102 Grove St., Worcester, Mass.

HYDRAULIC PRESSES: 1—Birdsboro, 1800 tons, down-acting ram 30" dia. x 24" stroke, 48" DLO, 42"x42" bed area. 1—Clearing, 500 tons, completely self-contained with controls for manual or automatic operation, suitable for compression and injection molding. 1—Farrell, 390 tons, 48"x48" steam platens, 2 openings, 4 rams 10" diam. x 24" stroke, approx. 15" per opening. 1—Watson-Stillman, 100 tons, 11¾"x12" platens, 22½" DLO, ram, 8" dia. x 15" stroke. 1—Watson-Stillman, 100 tons, down-acting, 22"x20" bed area, 24" DLO, ram, 11½" x9½"x6" stroke, self-contained; complete with 15 HP MD Vickers Pump. Unit is practically new. 1—HPM, 100 tons, 18"x18" Platen Area, ram 8" dia. x 18" stroke, 39" DLO, Steel Cylinder, 4000 PSI. 2—Burroughs, 75 tons, down-acting, 17½"x17" electric-heated platens, 13½" DLO, ram, 8" dia. x 10" stroke, complete with 7½" HP MD Oilgear Pump. 1—Watson-Stillman, 50 tons, down-acting, platen area 25"x 25½", 25" DLO, ram, 8" dia. x 14" complete with 7½ HP MD Pump. 1—New Laboratory Press, 12 tons, hand operated, fitted with 8"x8" electrically heated platens. 3—Denison, 4 tons, Model FH4-CO1, down-acting ram, 3½"x12" stroke, 18" DLO, bed 22"x14", 8¼" throat, complete with 3 HP MD Pump, time delay control, all valves, piping, gauges, controls. 1 machine slightly used, 2 units still in original crates. 1—Standard Machinery Co. #14 Toggle Press, 150 tons, platen area 34"x28", 6" DLO, 3½" stroke, arranged for motor drive, practically new. ALSO: Plastics & Rubber Extruders, Mills, Mixers, Grinders, Injection Molding Machines, Pumps, Valves, Platens, etc. JOHNSON MACHINERY COMPANY, 683 Frelinghuysen Avenue, Newark 5, New Jersey. Tel. Bigelow 8-2500. What have you for sale? What are you looking for?

WE HANDLE HYDRAULIC PRESSES, pumps and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

STOKES ROTARY PELLET PRESSES (5): 16-punch RD-3 and 15-punch RDS-3. (2) Kux model 25 Presses 21 and 25 punch. Ball & Jewell #11½ stainless steel rotary cutter. Mikro Pulverizers #1-SH, #1-SI, #2-TH, #2-SI & 24". Large stock steel and stainless tanks and kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Philadelphia 22, Pa.

FOR SALE AT GREAT SAVINGS
Colton 2RP and 3RP Rotary and 4T Tablet Machines. Day 40x120 Single Deck Sifter. Great Western—all models. Mikro Bantam, 1SH, 2TH, 3W, 3TH, 4TH Pulverizers; Schutz O'Neill Mills. Baker Perkins Heavy Duty Steam Jacketed, Double Arm from 12 to 150 gal. Mixers. (Unidor and Vacuum also) J. H. Day, from 4 up to 75 gal., Imperial and Cincinnatus, D. A. Jacketed, Sigma Blade Mixers. Day & Robison Dry Powder Mixers, 100 up to 10,000 lbs. Package Machy, FA, FA4, Miller, Hayssen 3-7, Scandia auto, Wrappers. Hudson Sharp Campbell auto. Cellophane Wrapper.
REBUILT AND GUARANTEED—This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements.
UNION STANDARD EQUIPMENT CO.
318-322 Lafayette St., New York 12, N. Y.

FOR SALE: Rubber and Plastic Equipment. Farrell 16" x 48", 15" x 36" and 6" x 12", 2 roll rubber mills. Other sizes up to 84". New Seco 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. Stokes #280, 4" diam. Preform Machine. W.S. 300 ton downstroke Hydr. Press, 30" x 30" Platens self contained. 350 ton, 22" x 24". New Loomis 340 ton & 50 ton Hydr. Presses. 24" x 56" Platens. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. W.S. 150 ton 30" x 60". 100 ton 24" x 24". Elmes 75 ton 30" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump. 250# W.P. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machines ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers 100, 50, and 9 gal. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N.Y. STerling 8-1944.

SAVE WITH GUARANTEED REBUILT EQUIPMENT: 2 New R. D. Wood 500 ton EMBOSSING PRESSES: 54"x26" platen: HYDRAULIC PRESSES: 42"x37", 20" ram, 475 tons; 2-7 opening 27"x27", 18" ram, 565 tons; 24"x24" 12" ram, 170 tons; 24"x20" 10" ram, 118 tons; 20"x20" 10" ram, 118 tons; 20"x20" 10" ram, 200 tons; 30"x20" 8" ram, 75 tons; 24"x20" 8" ram, 75 tons; 14"x14" 8" ram, 75 tons; 15"x15" 8" ram, 75 tons; 2-19"x24" 10" rams, 78 tons; 12"x12" 6½" ram, 50 tons; 14"x14" 8" ram, 50 tons; 8"x9½" 4½" ram, 20 tons; 16"x16" 3½" rams, 12 tons; PREFORM PRESS: Colton 5½T, Reeves Drive and Motor; LABORATORY PRESSES: Carver & Watson Stillman Units; NEW UNIVERSAL DUAL PUMPING UNITS: 3-15 HP; NEW LABORATORY MILLS, and CALENDERS; EXTRUDER: Modern Plastic 1½"; ACCUMULATOR; HPM 6" ram 2500#, also Mixers, Vulcanizers, Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO. INC., 285 Hudson Street, New York 13, N. Y.

FOR SALE: Reinforced Plastics Press 54" x144" Pl. Injection Presses: 32 oz, 24 oz, 12 oz, 4 oz Reeds. 4 oz, 9 oz HPM. 8 oz, 16 oz Lester, 6 oz Watson, 4 oz (1952) Impco, 1 oz VanDorn, 4 oz Makray. Extruders: 1½" & 2½" NRM, 1-¼" MPM w. crosshead. Scrapgrinders, Ovens. Laboratory Presses. Compression Presses. 1- Stokes automatic 50 tons Model 235A. Preformpresses: Colton 5½ T, Stokes 280C. Kux 25. 42" Slitting & Rewind. mach. 1- Industrial Ovens' complete Wire Coating & Drying unit. 3 HP Gasboilers. List your equipment with me. JUSTIN ZENNER, 823 Waveland Ave, Chicago 13 Ill.

FOR SALE: One 8 oz. Reed-Prentice Injection Molding Machine, 1942 model, located in the New England area. Will consider any reasonable offer. Reply Box 1117, Modern Plastics.

FOR SALE: 1—6"x12" Lab. Roller Mill; 1—Baker Perkins Banbury type 10 gal. Mixer, with pressure cover, m.d.; 4 Bolling 18"x18" 5-opening Hydraulic Presses; 1—HPM 4-oz. Injection Molding Machine; 2—Ball & Jewell Rotary Cutters; 1—100 gal. Patterson Kneadermaster S/S Mixer; 1—Eureka Rotary Cutter; 1—500 gal. Patterson Reaction jack. agit. Resin Kettles; 7—Dry Mixing Blenders, up to 11,000#; 1—Day Roball 82 Sifters, 40" x 120" screens; 2—Rotex #12, 20"x37" screens; 1—Retex 30"x48" Sifter; 3—Mikro Pulverizers 2TH, 3TH, 2DH; 1—Reed-Prentice 4 oz. Model 10A Injection Molding Machine. Also Grinders, Extruders, Compression and Injection Molding Presses, etc. Send us your Inquiries. Advise us what you have for sale. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N.Y. BArclay 7-0600.

FOR SALE: VIRTUALLY NEW BEARDSLEY AND PIPER 30 Inch Speed Densifier. 4 cu. ft. batch capacity. Complete with skiphoist and automatic temperature and cycling controls. Designed especially for mixing molding compounds. Reply Box 1128, Modern Plastics.

FOR SALE: 1 oz. Van Dorn Injection Molding Machine Model No. H200. New 1946. Used for experimental runs only. Excellent condition. Can be seen in operation. Price One Thousand Dollars. AMERICAN PLASTICRAFT COMPANY, 2027 Williamsbridge Road, Bronx 61, N.Y. Tel. TA 2-3929.

TWO 28-oz. WATSON-STILLMAN Injection Molding Machines for sale. Built 1947 & 1948, complete with 28-oz. and 32-oz. cylinders. Can be inspected in production. Write Box 1110, Modern Plastics.

FOR SALE: POLYVINYL ACETATE UNIT, capacity 1000# per hour. Includes, 500 gal s/s Reaction Kettle with Condensers and Xpl motor; 6' dia. x 15' long s/s, d.h. Rotary Resin Dryer; solid bowl type, all s/s Centrifuge, 30" x40", m.d.; 3—s/s Tanks, 500 gal., 250 gal.; 3—s/s Pumps with Xpl motors. Equipment is NEW, entirely of 316 stainless. Priced at fraction of new cost. Drawings available. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

MACHINERY and EQUIPMENT WANTED

MANUFACTURER'S EXPANSION PROGRAM Requires Good, Modern Compression Molding Equipment.
Transfer Compression
Molding Presses
(100 to 250 tons)
Preheaters and Preformers
WILL CONSIDER COMPLETE PLANT
Reply Box 1136 Modern Plastics

WANTED: Plant or Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

WANTED: Stokes Standard 150-300 ton Presses, large ram presses from 16" up. Large Preform Presses 11½" up. UNIVERSAL HYDRAULIC MACHINERY CO. INC., 285 Hudson St., New York 13, N. Y.

(*Continued on page 248*)

CLASSIFIED ADVERTISING

(*Continued from page 246*)

WANTED: Plastic injection moulding machines. Get our offer before you sell. ACME MACHINERY & MFG. CO., 102 Grove St., Worcester, Mass.

WANTED: 16-02 H.P.M. injection molding machines with or without preplasticizers. Late models. Must be in good condition. FRAWLEY MANUFACTURING CORPORATION, Salinas, Puerto Rico.

WANTED: Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider an operating or shut down plant. P. O. Box 1351, Church Street, New York 8, N. Y.

MATERIALS FOR SALE

MOLDERS OF DOLL PARTS
we offer regular supply
FLESH HIGH-IMPACT STYRENE
at attractive price.
CLAUDE P. BAMBERGER, INC.
152 Centre Street B'klyn 31, N. Y.
Tel: Main 5-5553
Not connected with any other firm of similar name.

ATTENTION TUBING USERS: FOR SALE: Vinyl tubing ¼" I.D. ⅜" O.D., Colors: Red, Green, Blue, Yellow—2600 ft. of each color. Vinyl tubing 15/64" I.D. ⅜" O.D., Colors: Red, Green, Blue, Yellow—5000 ft. of each color. Price of Vinyl tubing $75.00 per M ft. Black Rubber tubing: ¼" I.D. ⅜" O.D., 3,000 ft., 7/32" I.D. ⅜" O.D. 9500 ft. Price 25.00 per M ft. All prices FOB New Holstein, Wis. Reply Box 1118, Modern Plastics.

LARGE QUANTITY OF COROLITE (Sisal, impregnated with phenolic resins). Sheet size 6'x10'x½". Total weight 27,600#. Manufactured by Columbian Rope Co. No reasonable offer refused. SURPLUS & SALVAGE CO., INC., 620 W. 8th St., Jamestown, N. Y.

REPROCESSED POLYETHYLENE PELLETS, guaranteed good quality, free of contamination, clear, brown, and black. Low priced. Reply Box 1107, Modern Plastics.

MATERIALS WANTED

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N. Y. Telephone: MAin 5-7450.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate. Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 2004 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

WE ARE ALWAYS IN THE MARKET FOR THERMOPLASTIC SCRAP AND REJECTS OF ALL KINDS. Also surplus or obsolete lots of reprocessed and virgin materials purchased. Highest prices paid. Custom grinding and compounding to your specifications. PLASTIC MATERIALS, INC., 589 Main Street, Westbury, L.I., N.Y. DIAL—WEstbury 7-7124.

VACUUM FORMERS
SELL US YOUR SCRAP
Vinyl—Acetate—Hi-Impact
CLAUDE P. BAMBERGER, INC.
152 Centre Street B'klyn 31, N. Y.
Tel: Main 5-5553
Not connected with any other firm of similar name.

WANTED: SURPLUS UREA molding powder. Reply Box 1103, Modern Plastics.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic, Ethyl Cellulose. Reply Box 1105, Modern Plastics.

MOLDS FOR SALE

FOR SALE:
4 Molds designed to produce modern plastic lipstick holder consisting of: one 12-cavity Spiral Sleeve Mold. One 16-cavity Lipstick Holder Mold. One 24-cavity Lipstick Cover Mold. One 24-cavity Lipstick Cup Mold. These molds are new. Prices or additional information on request. STANDARD TOOL CO., Leominster, Mass.

DOLL HEADS for cloth and latex bodies. Walking and Non-Walking girl dolls. Reply Box 1109, Modern Plastics.

MOLDS WANTED

BRUSH MOLDS & BRUSH MACHINERY, injection molds for ladies, mens, military, nail, toothbrushes, etc. Send particulars & samples. Box 382, REALSERVICE, 110 West 34th St., New York, N. Y.

PLANTS FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 1101, Modern Plastics.

PLANTS WANTED

COMPRESSION MOLDING PLANT
Wanted by reputable manufacturer
Will purchase assets or corporation stock
All replies strictly confidential
You are dealing with principles
Will consider individual machines
Reply Box 1137, Modern Plastics

HELP WANTED

CHEMIST, PLASTIC—with experience in polyester glass, vinyls, to do development work in plastic fabrication. Salary. Write Qualifications. HEIL PROCESS EQUIPMENT CORP., 12901 Elmwood Avenue, Cleveland 11, Ohio.

PLASTICS TESTING
SENIOR TECHNICIAN
To supervise a modern and fully equipped physical testing laboratory handling a wide range of plastic products. This is a position of responsibility requiring a high caliber technician with a high school education and extensive experience in the physical properties of plastics. Some college training in engineering, physics, or general science preferred but not mandatory.
CHEMISTS or ChE'S
1. Adhesives and/or wire coatings and/or printing inks
2. Reinforced plastics applications
3. Protective coatings
The expansion of Celanese's research facilities creates these permanent positions in the Research Laboratories in Summit, New Jersey, a pleasant residential community within 30 minutes of New York City. Salaries will be based on ability and experience; promotional opportunities are excellent. Please submit complete resume of background and experience to Mr. J. A. Berg, Head—Personnel Administration.
CELANESE CORPORATION OF AMERICA
Summit, New Jersey.

GENERAL MANAGER WANTED for compression molder under new ownership. Southern location. Must have proven ability to handle all aspects of business. Products are staples sold to manufacturers and jobbers. Company is expanding custom molding and developing product lines. Salary and extra compensation are open. Resume desired. Reply Box 1123, Modern Plastics.

MOLD DESIGNER NEEDED—Large engineering company in midwest in need of designer familiar with the design of matched molds and half molds used in reinforced plastics. Include complete discussion of experience and salary requirements in first letter. Reply Box 1106, Modern Plastics.

TECHNICAL SALESMEN WANTED—Position open with large Midwest color manufacturer to head up color sales to the plastics and rubber industries. Must have some experience in the use of color in the plastics and rubber fields. Excellent opportunity for advancement in a new department. Reply Box 1102, Modern Plastics.

WANTED—EXTRUSION ENGINEER with technical background and actual machine operation experience. Must have attained a responsible supervisory position. Be competent and well qualified. Salary open. 50 year old Midwestern Mfg. Company. Reply Box 1115, Modern Plastics.

CONSULTANT WANTED for Production of Alkyds for Alkyd Molding Materials. Reply Box 1132, Modern Plastics.

GENERAL FOREMAN Injection and Compression Molding. Large Midwestern Molder. Should be familiar with proper set-ups, inspection and good molding practices. At least 40 years of age with proven ability in efficiency and neatness. Excellent opportunity in progressive plant with some of the Country's largest equipment. Strictly confidential. KOLLER CRAFT PLASTIC PRODUCTS, INC., Fenton, Missouri (Suburb of St. Louis).

WANTED—YOUNG GRADUATE CHEMIST with some experience for Plastics, Coating Research and Development. Excellent opportunity to progress with an established New England firm. Reply Box 1135, Modern Plastics.

(*Continued on page 250*)

The singing child on this year's Christmas Seal is a symbol of hope and faith in the future . . . and a pledge to the present.

The *hope* is the eventual eradication of tuberculosis...the *faith* is in the proved methods of your national, state, and local tuberculosis associations.

The *pledge* is your joining with 13,000,000 of your fellow Americans who this year will buy and use Christmas Seals.

Send your contribution to your tuberculosis association today, please, and join in singing to all humanity, to all the world, "Happy Christmas, Little Friend."

Buy Christmas Seals

Because of the importance of the above message, this space is contributed by

MODERN PLASTICS

CLASSIFIED ADVERTISING

(*Continued from page 248*)

PLASTIC'S ENGINEER
Good opportunity for man experienced in plastic mold design and product development, to head production development on new plastic for industrial manufacturer. Chemical Engineering background helpful. Salary open. Give full business and personal history. Reply Box 1112, Modern Plastics.

OLD ESTABLISHED NEW ENGLAND Custom Molder doing compression, transfer, and injection molding requires SALES MANAGER thoroughly familiar with industry and industrial requirements. Replies held in strictest confidence. Our employees know of this advertisement. Submit complete resume. Reply Box 1125 Modern Plastics.

VINYL ACETATE EMULSION—Want technical consultant thoroughly experienced. Fee or employment basis. Reply Box 1134, Modern Plastics.

ENGINEER-FOREMAN to assume responsibility for experimental, tooling and production of reinforced plastic product. Must have thorough knowledge of polyester-fiberglass laminating techniques. Good opportunity in an established firm in a southwestern state. Submit resume of work experience and salary expected to Box 1104, Modern Plastics.

PLASTIC WIRE SUPERINTENDENT. Well-established New England manufacturer of insulated wire plans to expand its plastic wire operations and is looking for a qualified superintendent for this division. Knowledge of product specifications, manufacturing operations, and equipment plus supervisory experience are essential. A challenging and rewarding opportunity. Send full details including age, education, and experience to Box 1129, Modern Plastics.

SALES ENGINEERS to represent old-established injection molder. Press capacity 4 to 200 ounces. Tool room, painting, silk screening, hot stamping—all conveyorized. Straightline assembly. Automatic packaging equipment. Prefer experienced men and men with industrial contacts. Also men controlling one or more special deals. Large midwest plant. Give complete details. Personal interview to follow. Reply Box 1121, Modern Plastics.

SITUATIONS WANTED

SALES ENGINEER, with plastics experience and extensive industrial following in southern Ohio and Indiana and Louisville, Kentucky desires association with custom moulder and decorator. Can offer immediate opportunity to quote on large number of high volume items required by appliance manufacturers in this area. Please do not reply if not prepared to handle considerable volume from this territory. Reply Box 1127, Modern Plastics.

PLASTICS ENGINEER: 19 years experience in Compression Injection Extrusion with largest Plastics firms in the United States, also has experience in engineering production and sales. Just returned after year and a half as Consultant Engineer in South America. Willing to travel in the States or to Foreign country. Desires position with responsibility. Salary open. Complete resume on request. Reply Box 1138, Modern Plastics.

SALES ENGINEER, with broad experience in Extruded and Calendered Plastics, seeks challenging sales position with established manufacturing company. Interested in large volume operation or sales development. Top references. Please reply Box 1131, Modern Plastics.

SITUATIONS WANTED
Two potential immigrants to Canada require employment. At present in charge of plastic section of world famous toy manufacturer.
1. Engineer Foreman, installation and maintenance of Injection Moulding and Die Casting Machines, setting up and plant supervision.
2. Mould Maker, versed in mould tryout methods, (plastic and die cast) rectifying faults, modification and repair of moulds.

Reply Box 1119, Modern Plastics.

MECHANICAL ENGINEER—Graduate Mechanical Engineer, diversified experience in plant engineering with nationally advertised concerns in the chemical, rubber, and plastics field, doing supervision, maintenance, development and purchasing. Presently employed but seeking plant or production engineering position of greater responsibility. Age 28. Salary $7,200. Reply Box 1108, Modern Plastics.

TECHNICAL DIRECTOR: Ph. D. in Polymer Chemistry with thirteen years of accomplishment in thermoplastic molding powders and films, laminates, coated papers, fibers and adhesives. Expert in polymerization of styrene, vinyls, polyesters, acrylics and other monomers. Have increased sales volume by developing important new products, cutting formulation and production costs, improving quality. Registered patent agent. Reply Box 1124, Modern Plastics,

CHEMIST, ORGANIC: 5 years intensive diversified research and development experience including synthetic organics, dye intermediates, pharmaceuticals, organometallics, resins, plastisols and organisols. Adhesive formulation experience, epoxy and vinyl. Formulation work in epoxy potting resins, hardener and catalyst development. Research on vinyl plastisol and special plasticizer systems. Reply Box 1116, Modern Plastics.

SALES AGENTS WANTED

SALES REPRESENTATIVE WANTED by established Southern compression molder. New York City. Other territories available later. Sell to clothing manufacturers, jobbers and retail chains. Opportunity to develop custom molding business. Salary and commission. Please submit resume. Box 1122, Modern Plastics.

WANTED SALES REPRESENTATION for the Republic of Mexico. For handling printed and embossed vinyl films suitable for rainwear, shower curtains, tablecloths and general uses—Commission basis—Please give full details. References will be exchanged. Reply Box 1113, Modern Plastics.

CUSTOM MOLDING REPRESENTATIVE: Rapidly expanding Midwest Custom Injection Molding Company requires representation in all midwest industrial areas on commission basis. Applicant assured of excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Reply Box 1126, Modern Plastics.

MANUFACTURER'S REPRESENTATIVE—Wanted to promote sales of injection molded plastic items for large midwest company with complete facilities, specializing in industrials. Protected territory. Reply Box 1133, Modern Plastics.

MISCELLANEOUS

CONTACT WITH TOP RATE AMERICAN COMPANY sought by LEADING BRITISH INJECTION MOULDERS of household articles, toys and packagings with a view to renting tools. Advertisers produce their own tools which are first class, and would be willing to hire these on exchange basis to American correspondents, with whom they establish contact. Reply Box 1120, Modern Plastics.

FOR SALE: ACETATE, white, ivory, pink pastels, red, blue and green, at 28c per pound, F.O.B. New York, regular supply. Odd colors 23c.
16 OUNCE IMPCO Injection Machine, without press, $5000.00.
WANTED: a 350 ton Toggle Press.
PEERLESS CHEMICAL CORP.
181 Greene Street, N. Y. C. 12.

CONTINUOUS PROCESS—We have developed a machine for producing Polyester-Fiberglass rigid, flat or corrugated endless sheets. Desire financial assistance to set up for production or possible partnership with interested individuals or consolidation with going plastic concern. Reply MR. R. PRICE, c/o 93 Plymouth Ave., Swampscott, Massachusetts.

SPACE FOR RENT—Loft units of from 5,000 to 15,000 feet per floor, fully heated, sprinklered, watchman service, central Connecticut. Write or phone for appointment. HARTFORD SPINNING INC., Unionville, Connecticut.

PLASTIC SALES REPRESENTATIVE with many years of successful operation to his credit would like to acquire part interest in a well equipped small injection moulding plant located in the State of New York, Penn or Ohio. Prefer a plant that has its own die shop and room for expansion. Reply Box 1130, Modern Plastics.

MEDIUM SIZE COMPANY wishes to manufacture vinyl and polyethylene extruders and 2 to 16 ounce injection molding machines. Will purchase designs outright or may manufacture on royalty basis. Reply Box 1111, Modern Plastics.

ESTABLISHED FIRM WILLING TO FINANCE small calendering operation. Also desirous to contract for part of production. Reply Box 1114, Modern Plastics.

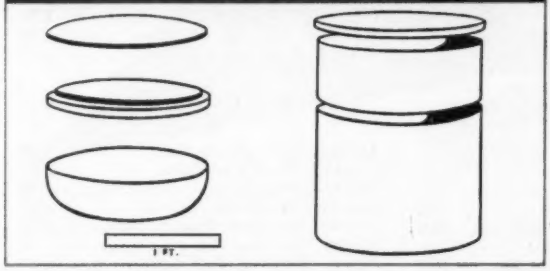
All classified advertisements payable in advance of publication
Closing date: 28th of the second preceding month, e.g., October 28th for December issue.

Up to 60 words $10.00	Up to 120 words $20.00	Up to 180 words $30.00
Up to 60 words (boxed) $20.00	Up to 120 words (boxed) $40.00	Up to 180 words (boxed) $60.00

For further information address Classified Advertising Department,
Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

Whatever

MOLDS ON HAND



The Chemold Company is equipped to turn out any polyester resin glass fiber products ranging from 32"x96" ribbed or flat translucent building panels, to other compound curvature shapes using Chemold's 250-ton presses.

Write for information today.

CHEMOLD

CHEMOLD

"LARGEST MATCHED METAL MOLD PRESSES IN THE WEST"

Arctic Sleds Molded in One Operation

Above is one of a battery of giant matched metal mold presses capable of stamping out one reinforced glass-fiber Arctic Sled every 4 minutes for Armed Forces use.

Got a Problem Product?
Chemold's Matched Metal Molds May Produce it FASTER, BETTER, CHEAPER

AT CHEMOLD COMPANY you may discover the answer to your manufacturing problems. For CHEMOLD offers you top-flight technical know-how, backed by largest matched metal mold press installation in the West. Perhaps one of our existing molds can be converted to your own use. If not, a special mold made at low cost for your own exclusive use may provide the solution you seek. May we be of service?

CHEMOLD COMPANY, DEPT. MP-11
2310 Broadway, Santa Monica, Calif.

☐ Send details on Matched Metal Mold Process.

NAME_____

FIRM_____

ADDRESS_____

CITY_____

INDEX OF ADVERTISERS

NOVEMBER 1953

MODERN PLASTICS

575 MADISON AVENUE • NEW YORK 22, N.Y

19 Ways to Get Splendid CUSTOMER Reception

WMP's answers to scores of die design, material selection, moulding and finishing problems are moulded right into these 19 handsome best-sellers. To our customers, the manufacturers of these radios, this means *better* products at less cost — greater in beauty, consumer acceptance, durability and production economy.

Let WMP work with you on your injection moulding. Whatever your requirements — from small, intricate parts all the way up to giant 22½ pound mouldings, with partial or complete vacuum metallizing — you'll find the experience and facilities at WMP valuable assets to the sales success of your product. Write, phone or pay a visit to WMP in Worcester. We'll be happy to send our plane for your personal visit.

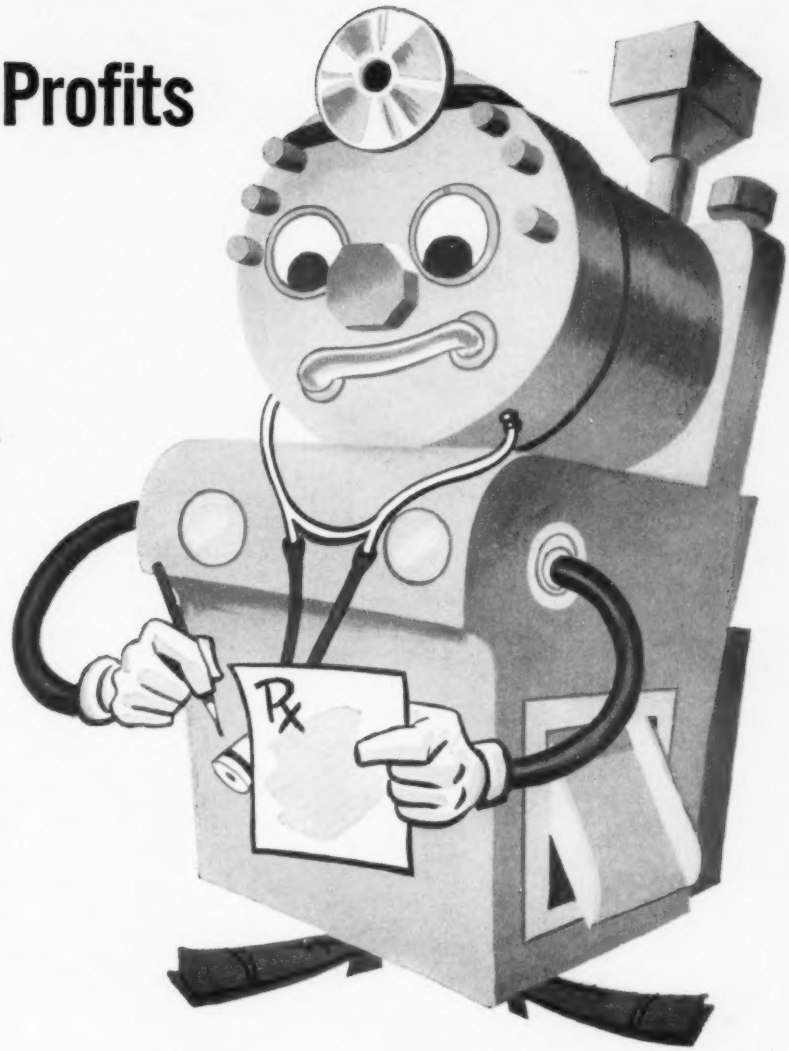
Custom Injection Moulding

WORCESTER MOULDED PLASTICS CO.

14 HYGEIA STREET, WORCESTER 8, MASS.

For Healthier Profits

take the FLEXIBLE treatment



Is YOUR BUSINESS suffering the ill effects of confinement to a single, limited market? Let *flexible* products stimulate your profits! With BAKELITE flexible Vinyl Plastic molding compounds you can produce for the big, growing flexible market—and on your present machinery! No added investment—these materials can be fabricated on standard molding machines!

Here are the properties of BAKELITE flexible Vinyl Plastic molding compounds. Look them over! They tell a convincing story of practically unlimited product variety . . . great sales potential . . . excellent profit possibilities.

FLEXIBILITY . . .
to almost any degree, from soft and rubbery to semi-rigid . . . withstand long flexing without cracking.

COLOR . . .
in practically every shade . . . in transparent, opaque or translucent form with lustrous finish.

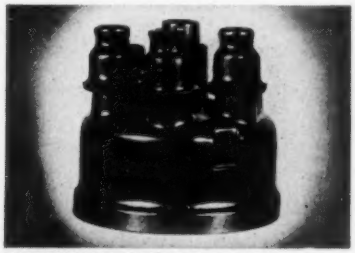
DURABILITY . . .
non-fading, abrasion-resistant . . . deliver extra-long service.

RESISTANCE . . .
to oils, most chemicals, corrosive atmospheres, greases, water, alkalies.

ADAPTABILITY . . .
to high speed injection molding or extrusion. The temperature range for successful molding is highly flexible.

It takes only a glance at these outstanding properties to suggest possibilities for *your* business. Take the first step by writing today for our illustrated booklet, "Vinyl Extrusion and Molding Resins and Plastics." Address Dept. RS-13.

HANDSOME APPEARANCE and utility mark this Electrolux floor polisher part, molded of BAKELITE flexible Vinyl Plastic compounds. The smooth finish adds to its attractive design. It's durable, resilient, won't mar furniture. By Hungerford Plastics Corp., Rockaway, N. J.



LIFELONG SERVICE in distributor cap nipples is assured when they're molded of BAKELITE flexible Vinyl Plastic compounds. They are unaffected by destructive ozone, stay soft and flexible for the life of the automobile. By Hungerford Plastics Corp., Rockaway, N. J.

BAKELITE
TRADE-MARK
VINYL PLASTICS
TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.

How G-E plastics research helps you

GET MORE FOR YOUR MONEY

G.E.'s COMPLETE MOLDING SERVICE OFFERS YOU—

- Complete mold-making facilities
- Impartial material selection
- Injection presses from 3 to 208 ozs.
- Compression presses from 3 to 36 ins.
- Complete silicone rubber fabricating facilities
- Complete molded mycalex facilities

PLUS the benefit of 61 years' experience in designing, engineering and molding plastics parts.

The continuous program of plastics research behind General Electric's plastics molding service helps you get more for your money by assuring the latest and best materials, molds and press facilities for *your* job.

At G.E. you find constant evaluation of new plastics materials . . . cost-saving developments like chrome-plated molds for longer wear . . . cycle-controlled presses for greater uniformity of molded parts.

G.E.'s *complete* molding service is ideally equipped to supply the plastics parts you need quickly and economically. For *your* next molding job, why not see G.E. *first?* Just write to General Electric Company, Section 1340-6A, Chemical Division, Pittsfield, Massachusetts.

You can put your confidence in—

GENERAL ELECTRIC